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*Counsel*

August 1, 2002

Mary L. Cottrell, Secretary  
Department of Telecommunications and Energy  
One South Station  
Boston, MA 02110

**Re: D.T.E. 02-38**

Dear Secretary Cottrell:

I am enclosing the Initial Comments of Massachusetts Electric Company and Nantucket Electric Company in the above-captioned matter. Thank you very much for the opportunity to provide comments.

Very truly yours,

Amy G. Rabinowitz

cc: Joseph Rogers, Office of the Attorney General

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Massachusetts Electric Company  
and  
Nantucket Electric Company

Response to Request for  
Comments on:

Distributed Generation

August 1, 2002

Submitted to:  
Massachusetts Department of  
Telecommunications and Energy  
Docket D.T.E. No. 02-38

Submitted by:



## **Executive Summary**

Distributed generation gives rise to many complex technical, operational, regulatory and economic issues. Although there may be situations where distributed generation can provide benefits to the distribution system, this is not always the case. The Department should carefully consider the range of issues associated with distributed generation, and try to assure that the true costs and benefits of integrating distributed generation into the distribution network are apportioned fairly so that the installation of such generation is neither inappropriately discouraged nor artificially encouraged.

## **Interconnection Standards and Procedures**

Mass. Electric's interconnection requirements document is included in the Company's Tariff, M.D.T.E. No. 1052. The Company's interconnection provisions set forth a detailed step-by-step process for the evaluation of all interconnections to the distribution system. In all cases, the Company's interconnection provisions are open, transparent and enforceable. Proposed generation projects that present little potential impact to the distribution system (e.g., small renewable installations) undergo a streamlined review process that provides timely approval to enable connection of such projects. Larger generation projects are subject to a more comprehensive review to assure that the safety, reliability and operational performance of the distribution system are maintained. The level of specificity in the requirements document reduces the risk of arbitrary or inconsistent application, while at the same time assuring a level of review that is commensurate with the complexity or potential impact of any proposed project. The Company's currently effective interconnection standards do not act as a barrier to distributed generation; however, we continue to seek to improve the procedures.

Mass. Electric continues to work with industry groups, such as the IEEE, to further develop and refine interconnection engineering standards in the face of continually advancing technologies and industry and customer needs. The Company also is working with other utilities in the Commonwealth to achieve greater consistency among utilities in their interconnection procedures where possible.

### **Standby Tariffs**

Mass. Electric does not presently have a traditional standby service rate. Rather, its Auxiliary Service Provisions provide that a customer with on-site generation is to take service pursuant to the filed rate that would apply if the customer had no generation.

The appropriate rate design for customers with on-site generation should reflect the same principles that apply to all rate designs: fair apportionment and recovery of the costs imposed on the system by the customer, prevention of undue cost-shifting, and encouragement of economically efficient decisions. Customers with on-site generation can impose a wide range of impacts on the distribution system. To the extent that such customers rely upon the distribution system to serve as a full and complete backup to their on-site generation at all times, there may be no potential cost savings on the distribution-side as a result of such generation (indeed, the investment needed to maintain the safety and performance of the local distribution system may actually increase). However, if a customer with self-generation is willing to limit its reliance on the distribution system, there may be cost savings opportunities, which may be reflected in savings to the customer.

In addition, there may be other cases where the placement of certain types of distributed generation may provide positive distribution benefits. For example, where a distributed generation resource can be used to defer the implementation of a large investment in distribution

system infrastructure, the benefits from such a deferral may be quantifiable. However, these situations will be highly dependent on the location of the distributed generation, the timing of its implementation (to coincide with distribution system needs), and the cost of the distribution infrastructure investment that is being deferred. Once a deferred investment can no longer be deferred, the distribution system value of the distributed generation ceases for the foreseeable future. The design of standby rates for distributed generation should reflect these varied considerations.

### **Distributed Generation in the Provision of Distribution Service**

The ability to successfully incorporate distributed generation in the provision of distribution service and distribution planning depends on several factors. In essence, the distribution utility should have a comparable level of control and confidence in a distributed generation resource that it has in a distribution infrastructure investment. Unless distributed generation resources exhibit reliability and performance parameters comparable to those of traditional distribution system facilities, the value of such resources is limited. Mass. Electric, through its Load Curtailment Pilot Program in Brockton, Massachusetts, is currently testing the viability of using distributed resources (which may include distributed generation) to supplement distribution system planning.

Distribution system planners should begin to identify those areas within the system where consideration of distributed generation resources may be appropriate. These include areas where projected load growth is relatively slow and predictable (high growth areas are not good candidates for distributed generation), and where the value of deferring a traditional distribution infrastructure investment is significant. This is the approach the Company is implementing in connection with its Brockton Pilot, and the results of the pilot should produce useful information.

## **Other Considerations**

Greater penetration of distributed generation will change the nature of the service provided by the distribution system. The Department should assure that any such changes are achieved in a way that is fair and does not require non-generating customers or the utilities to subsidize self-generating customers. Finally, the Department should consider what effects, if any, the recent initiatives at the federal level regarding the interconnection of generators to the distribution system might have.

**COMMONWEALTH OF MASSACHUSETTS**  
**BEFORE THE DEPARTMENT OF TELECOMMUNICATIONS AND ENERGY**

|   |                       |                      |
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| Investigation into Distributed Generation | )<br>)<br>)<br>)<br>) | Docket No. DTE 02-38 |
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**COMMENTS OF**  
**MASSACHUSETTS ELECTRIC COMPANY**  
**AND NANTUCKET ELECTRIC COMPANY**

Massachusetts Electric Company and Nantucket Electric Company (together “Mass. Electric” or “Company”) submit these initial comments in response to the Department of Telecommunication and Energy’s (“Department”) Notice of Inquiry (“NOI”) issued June 13, 2002, in this docket. Mass. Electric also will review other initial comments filed with the Department and determine whether it will submit reply comments by August 15, 2002, and the Company intends to participate in the public hearing scheduled for August 21, 2002.

As noted by the Department in its NOI, distributed generation may be an important resource option in the restructured electric industry. However, there are several considerations that must be addressed for distributed generation to achieve its potential benefits. The Company addresses these issues in its responses to the questions posed in the Department’s NOI.

**Response to Inquiries**

- 1. Refer to current distribution company interconnection standards and procedures in Massachusetts. Do these standards and procedures act as a barrier to the installation of distributed generation? If so, please describe.**
  - a. If the current standards and procedures act as barriers to the installation of distributed generation, please describe what steps the Department should take to**

**remove these barriers. As part of this response, please discuss whether the Department should establish uniform technical interconnection standards and procedures for distributed generation.**

Typically, distributed generation (“DG”) is defined as the generation of electricity near its intended point of use. Unlike large central station generators that interconnect to the high-voltage transmission network, DG generally is connected to the lower voltage distribution network, and is often located at a customer’s facility (i.e., “on-site”). The distribution network typically is radial in nature, serves end-use loads in a unidirectional manner, and serves a more closely associated group of customers than the transmission system. The Company’s typical distribution feeder serves 5MW to 10MW of load. Because of the relatively localized nature of the distribution system, the addition of even relatively small amounts of generating capacity directly at the distribution level can have significant local effects. DG is customer-owned, not Company-owned. Owning DG, other than for reliability reasons or to discharge a legal obligation, is not part of the Company’s business plans, especially given that the Company, through its affiliates, has undergone an extensive divestiture of generation. Those affiliates are pursuing opportunities to become or manage independent transmission companies, and are not able to have any economic or commercial interests in market participants such as DG under the Federal Energy Regulatory Commission’s (“FERC’s”) Order No. 2000, *see* 18 CFR§35.34(a)(2).

The purpose of interconnection standards is to assure that customer-owned generating resources are connected in a way that preserves the safety, reliability and operating performance of the distribution system. Mass. Electric’s currently effective interconnection requirements document was approved by the Department earlier this year (Docket D.T.E. 01-76), and is set forth in the Company’s tariff M.D.T.E. No. 1052. A copy of the Company’s interconnection requirements document, attached as Exhibit 1, describes the process for interconnecting customer-

owned generation as small as 10 kW or less, to over 1MW. It is consistent with the Department's regulations for qualifying facilities and on-site generating facilities, 220 C.M.R. 8.00 et seq., although it also applies to generation which is not either a qualifying facility or on-site generating facility, as defined in the Department's regulations. Because the connection of large generating resources can have a greater effect on the distribution system than the connection of smaller resources, the Company's interconnection requirements document simplifies the process for small customer-owned generating facilities, while assuring an appropriate level of review for the connection of larger resources.

The document describes the information required from the customer, which in many cases can be completed on a one-page form, and the steps to be taken before interconnection is allowed. For generating systems of 10 kW or less, typically applicable to residential customers installing renewable energy technologies (e.g., solar, wind), the document provides a simplified interconnection process that nevertheless assures protection of the distribution system, the customer's generating facility ("GF"), other customers served by the same circuit, and public safety. The process for interconnecting small (10 kW or less) customer-owned generation is attached as Exhibit 2.

As the size of the customer-owned generation increases, so too does the potential impact on the distribution circuits. For GFs larger than 60 kW, the output can be a significant fraction of either the transformer serving the customer or the distribution feeder itself. In such a situation, it is necessary to consider how the GF would contribute to fault (short-circuit) current, whether voltage regulation would remain satisfactory as the GF comes on-line or goes off-line, whether the existing circuit components have sufficient capacity to accept the GF output, and whether there is sufficient capacity to provide adequate backup. Such issues would be considered as part

of the Distribution Facilities Impact Study, which is an initial review of the potential impact of a GF on the feeder. This study (described further in the Company's interconnection requirements document) provides an initial determination of whether changes (such as capacity upgrades) are needed to the distribution system to accommodate the GF. Details of the needed system modification, as well as all estimated costs, would be covered in the Distribution Facilities Detailed Study. Customers adding GFs would be responsible for the costs of any distribution system upgrades needed to accommodate the added generation. Upon agreement of the cost estimates associated with any upgrades and execution of an interconnection agreement, construction and the interconnection process proceed.

The procedural steps from start to completion of an interconnection are set forth graphically in Exhibit 3. It is expected that GF Category 1 (10 kW or less) installations will not typically require the two distribution facility studies noted, and that most Category 2 (10 kW to 60 kW) installations will not require more than the first study, which examines the potential impact of the GF on the local distribution system.<sup>1</sup> Therefore, the level of analysis associated with any interconnection corresponds to the potential impact of the GF on the distribution system.

Mass. Electric's interconnection provisions establish an open and transparent, easy to follow, and enforceable process. The level of detail and specificity in the interconnection provisions help assure that they are applied fairly and evenly for all participating customers and reduce the potential for arbitrary or inconsistent application that might occur with less detailed procedures. Although the interconnection provisions are comprehensive, they are designed to assure there is an appropriate level of review of large projects that may significantly affect the

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<sup>1</sup> The Company's interconnection process, included in Exhibit 1, establishes five size categories of on-site generation facilities.

distribution system and service to other customers, but that the review for smaller projects is also appropriate and not unduly burdensome.

**b. Please comment on whether the Department should adopt the IEEE's uniform technical interconnection standards, or the uniform standards adopted by other states, for use in Massachusetts.**

Mass. Electric is actively participating in the development of the IEEE Standard P1547, which is still in draft form and not yet approved by the IEEE Standards Board. It is very likely that, once adopted by the IEEE, the Company will recommend that this new standard become part of DG interconnection procedures in Massachusetts. However, it should be noted that it is very likely that IEEE Standard P1547 will employ general guidelines for interconnection in contrast to very specific requirements. As recently noted in the trade press:

[a] standard that addresses all possible technologies, installation scenarios, and distribution system variants is a tall order indeed...The accumulated experience to date and our engineering intuition tell us that some streamlining in the interconnection process is possible. But because it's impossible to address all of the variants within one document, utility-specific guidelines should still remain the last word. Defining the largest possible 'common denominator' to reduce the burden on equipment manufacturers and project engineers is a worthy goal, and one that Standard P1547 will most likely address.<sup>2</sup>

Thus, if ultimately adopted by the IEEE, the Company would likely propose to include P1547 as part of its general requirements for interconnection just as it presently includes IEEE 929-2000 and UL 1741.

The Company also has been coordinating with other Massachusetts utilities with the aim of achieving greater statewide consistency. Following discussions earlier this year with the Northeast Combined Heat and Power group (sponsored by the U.S. Department of Energy), Mass. Electric, along with the State's other investor-owned utilities, began work towards the

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<sup>2</sup> *Power Quality, Working Group Struggles with DG Interconnection Standard*, Robert Zavadil and Mark McGranaghan, Electrotek Concepts (June 1, 2002), available at: [http://powerquality.com/ar/power\\_working\\_group\\_struggles/index.htm](http://powerquality.com/ar/power_working_group_struggles/index.htm).

development of a common interconnection process. At this time, the companies have agreed to implement a common process by October 1, 2002, for the interconnection of residential systems sized at 10 kW or less, which use a UL1741 compliant inverter. Further discussions are anticipated with the goal of achieving a set of common standards for other interconnections by year-end.

Regarding the processes followed in other states for DG interconnection, the Company has been reviewing policies in California, Texas and New York over the past several years. In addition, the Company has reviewed the newly-proposed NARUC model agreement. Mass. Electric's existing interconnection requirements document incorporates, in the Company's view, the best features from these sources. Mass. Electric does not believe that greater adoption of the interconnection provisions or concepts from any other state will improve the currently effective document. Nevertheless, the Company is always receptive to changes that may advance or improve its processes and procedures.

**2. Refer to current distribution company standby service tariffs. Do these tariffs act as a barrier to the installation of distributed generation? If so, please describe.**

Under Mass. Electric's current Auxiliary Service Provisions on file with the Department (M.D.T.E. No. 1031-A), customers with on-site generation that are served by the Company for the balance of their load receive retail delivery service pursuant to the same tariff provisions that apply to other similar customers with no on-site generation. In other words, customers receiving service under these [Auxiliary Service] provisions will pay for electricity under the provisions of the file[d] rate on which they take service." Mass. Electric Tariff M.D.T.E. No. 1031-A. Thus, the present Auxiliary Service, or standby, tariff does not distinguish between the charges for retail delivery service to customers with on-site generating facilities and charges for retail delivery service to those with no on-site generation.

Because all usage under the Company's currently effective general service rates is determined on an as-delivered basis, customers that run on-site generation (and therefore whose deliveries are less than their overall usage) generally are assessed lower overall distribution charges than customers with comparable overall usage that do not have on-site generation. This is so even if the distribution facilities needed to provide peak service to these customers are essentially the same. (The distribution system requirements to serve customers with on-site generation are described more fully below). As a result, customers with on-site generation are likely paying significantly less for distribution service than customers without generation, even though the costs associated with the distribution facilities required to serve those customers may be comparable.

Setting aside for the moment whether Mass. Electric's currently effective Auxiliary Service Provisions appropriately reflect the principles of cost causation and recovery,<sup>3</sup> it is the Company's view that its tariff is not a barrier to the installation of distributed or on-site generation. On the contrary, the Company believes that its current tariff may artificially encourage the installation of such generation. This is because under currently effective rates, a customer that utilizes on-site generation can avoid paying a portion of the costs of the distribution facilities needed to serve the customer's peak load (the customer's peak load being the maximum load without the on-site generating facilities operating).<sup>4</sup> Therefore, to the extent that the pace of distributed or on-site generation installations is perceived as slow, it likely has more to do with

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<sup>3</sup> Under Mass. Electric's Rate Plan Settlement in Docket D.T.E. 99-47, the Company is required to file a new Auxiliary Service proposal once the level of new customer-owned generating capacity (since July 1, 1999, and subject to certain qualifications) exceeds 15MW. Among other things, the Settlement provides that Mass. Electric's proposed Auxiliary Service rates "will be designed to recoup the net lost revenues attributable to the subset of customers to which the Auxiliary Service Provisions would apply." Rate Plan Settlement, Docket D.T.E. 99-47, at 12 (Nov. 29, 1999).

<sup>4</sup> It is also the Company's understanding that neither Boston Edison Company, Commonwealth Electric Company, nor Fitchburg Gas and Electric Company currently has standby service tariffs for customer self-generation or distributed generation. Therefore, customers are only charged for actual delivery over the transmission and distribution systems. Other utilities in the State do provide some form of distinct standby service. *See, e.g.,* Cambridge Electric (3 tariffs): Standby Service (firm delivery service with the obligation to serve), Maintenance Service (maintenance [energy and capacity] service with the obligation to serve [for when customer's generation is down for maintenance in accordance with provisions of tariff]), Supplemental Service (supplemental [energy needed to fulfill all of the customer's load requirements when it is supplying a portion]

larger economic or other factors considered by customers, rather than the effect of Mass.

Electric's distribution tariffs. Nevertheless, despite the fact that the Company's current tariff is not a barrier to new on-site generation, this tariff still is not appropriately designed for service to on-site or distributed generation, as discussed in Section 2.a below.

- a. Please discuss the appropriate method for the calculation of standby or back-up rates associated with the installation of distributed generation. As part of this response, please discuss whether other states have established policies regarding back-up rates associated with distributed generation that may be appropriate for adoption in Massachusetts.**

In considering the appropriate basis for a standby rate for on-site and distributed generation, the same principles applicable to general rate design also apply. These include that the rates should fairly apportion and recover costs imposed (or benefits conferred) on the system from the users of the system, should not encourage wasteful or uneconomic decisions, and should prevent undue cost shifting among customer classes.

The Department announced its present policy on backup rates in the 1980s: (Boston Edison Company, D.P.U. 1720 (1984); Cambridge Electric Company, D.P.U. 84-165-A; Massachusetts Electric Company, D.P.U. 85-146). The policy allowed customers with self-generation to receive service under rates identical to all other customers of similar size and usage characteristics for energy actually delivered to the customer. In D.P.U. 85-146, the Department disallowed the Company's auxiliary service rate, which had been a monthly demand-based rate. In its order, the Department stated that the Company did not provide evidence of differences in cost causation between customers with on-site generation and those without on-site generation, for example, by proving that variations in loads of customers with on-site generation are sufficiently different from the load variations of the Company's regular customers on similar

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service w/obligation to serve); Western Massachusetts Electric Company(1 tariff): Standby and Supplemental Power Service for Partial Requirements General Service Customers (closed effective 9/17/99); firm back-up, maintenance and supplemental service.

rates. The combination of these policies meant that customers with self-generation could avoid power costs for demand and energy from their utility. However, the restructuring of the electric industry, the unbundling of electric tariffs, and the further evolution of technology have changed the needs of the customer, have affected the basis of the assumptions that led to the prior policy and re-focused the debate on appropriate rates for customers with generation.

#### Customers with Load Served by On-site Generation

In general, a self-generating customer has two principal needs from standby service: (1) power supply when its own generation is inadequate and (2) adequate capacity to ensure delivery during periods of peak load. Because Mass. Electric no longer is in the energy supply business, its focus with respect to standby service is on the appropriate design of the distribution rate.<sup>5</sup> In today's restructured environment, customers have opportunities that did not previously exist. These opportunities can affect a customer's decision whether to run its on-site generation. The customer may choose to run its on-site unit consistently, or may arbitrage against the price of power in the spot market (or other available electric services) and run only when it is cheaper than buying in the market. Alternatively, the customer's "buy or generate" decision may be driven by the price and availability of fuel, or the "spark spread" between the costs of fuel and electricity. A customer may also contract with a third party to operate and maintain its generation under certain conditions to the benefit of the third party and the customer. The conditions existing today create the potential for greater variability in customer use of the distribution system than existed before restructuring.

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<sup>5</sup> Mass. Electric also is concerned about the potential disruptive effects of customers with generation arbitraging their generation costs against default service or standard offer prices. The Department should establish rules that limit the ability of customers with generation to arbitrage default service or standard offer prices if the effect of the arbitrage is to raise costs for other customers.

In addition, unplanned or forced outages can—and do—occur. In practically all cases, the decision whether to run on-site generation is made by the customer, not the utility. This lack of control by the utility makes it increasingly difficult for the Company to predict the level of loading that can occur on the distribution system at any given time. Further, because of the relative lack of generation technology diversity of that exists at the local distribution feeder level, the rapid addition or loss of a sizable amount of generation (relative to total feeder load) can have appreciable effects on the quality of service to other customers in the area. This issue is exacerbated as the level of penetration and scale of on-site generation increases. Thus, greater opportunities for customers with on-site generation translate into increased volatility of customer load on the distribution system and potentially greater impacts on customers that have no on-site generation. Clearly, from the standpoint of distribution system design, a customer with on-site generation could impose similar or greater risks and costs on the distribution system than a customer with no on-site generation, and the restructuring of the industry has increased the potential for these risks materializing.

### Distribution Planning Issues

The costs imposed on the delivery system by a standby service customer will depend on the level of standby service that customer desires, the amount of reliability associated with that service level, the effect on other customers of the operations of the generator, and the level of control provided to the utility in the operation of the on-site generation. The level of planning required to serve the customer must consider all of these factors. For example, a standby service customer that requires instantaneous and seamless delivery service in the event of a loss of on-site generation imposes a greater burden on the distribution system than a customer that is willing to

limit or delay its reliance on the distribution system in cases where it loses its on-site supply. In the first situation (i.e., where the customer requires instantaneous and seamless service), the distribution system must remain available to serve the customer's total needs fully and immediately and for an indefinite period. Thus, the distribution facilities needed to provide the standby service to such a customer are not any less than the distribution facilities needed to serve the customer as if there were no on-site generation. This is described further below.

A distribution system planner must assume worst-case scenarios for the distribution system in order for the system to remain reliable to customers for many years. For example, as the Department's recent investigations into reliability have shown, distribution system planners forecast loads on the distribution system using an extreme weather forecast, not average weather. The use of extreme weather is necessary because extreme weather does occur and causes the highest loadings on the system. Otherwise, the use of average weather for planning would result in a less robust distribution grid that would more quickly degrade over time due to the relative high loadings on the system during extreme weather periods. This would cause a worsening of reliability over time that is unacceptable to the Department, customers, and the Company.

In the same manner, the distribution system planner would need to plan for facilities to serve load that is currently served by customer-owned generation if the utility has no control over the customer's generation. The forecast would need adjustment to assume a scenario that all generation has stopped running at customers' facilities (e.g., to take advantage of market opportunities based on fuel or energy prices) in order to ensure reliable service to every customer.

For example, assume that the distribution system planner has a feeder capable of serving 10 MW of load. Further, assume that 4 MW of generation exists at customers' facilities and an additional load of 8 MW is not served by on-site generation. Thus, if the distribution system

planner can assume a diversity factor of 50% for the generator outages, the planner can also assume that the distribution system is appropriately designed: 10 MW of load can be served with 10 MW of capacity. However, if the planner's assumption is incorrect, service must be provided to 12 MW of load through the 10 MW feeder. The planner's dilemma is the utility's lack of control over the operation of the customer-owned generation: assuming diversity of generation outages without adequate control over the generating facilities will only result in degraded service to all customers over time and a more expensive distribution system since repairs or premature replacement will be needed for failed or degraded components. Thus, the appropriate design for the distribution system planner is for a system that can serve 12 MW of load, or greater, at any time. Further, the distribution facilities must be maintained to assure that they are capable, at any time, of providing the instant standby service that is required. As a result, the utility is unable to avoid any significant distribution costs due to the customer's election to install on-site generation, and the utility must design and maintain its distribution system as if the customer were a full requirements customer and not self-generating. This is consistent with the utility's "obligation to serve."

The distribution system planner also must recognize that a customer with self-generation is different from similar low load factor customers in the probability of bringing load onto the system quickly at any point in time. Customers invest in on-site generation if they have a significant load that can receive economic service from the generation over time. Serving the load with self-generation tends to lower the load factor of a customer on the system. However, the customer continues to have a probability of bringing significant load onto the system at any point in time.

In addition to planning for the loads served by local generation, distribution system planners must consider the impacts to other customers on the same feeders. Voltage swings from 5 MW of customer-owned generation turning on and off can be substantial and could seriously degrade service to other customers. Some customers are seriously affected by slight variations in voltage, and many customers can be affected by large swings in voltage. Significant customer-owned generation connected directly at the distribution level will require protection schemes that are not currently in use, particularly if the customer with on-site generation requests immediate, seamless delivery of electricity. Thus, distribution system planners will have a second dilemma and will need to determine appropriate, cost-effective means to protect other customers from dramatic swings in voltage.

If, on the other hand, a customer with substantial on-site generation were willing to accept a different level of standby service (e.g., limiting its maximum load to some lower level or foregoing the need of standby service to be “instantaneous”), that customer’s demand on the system would be lower, and the investment needed to provide the standby service likewise would be lower.<sup>6</sup> For example, the utility may have increased flexibility in field switching in the event of an outage and may be able to defer otherwise needed capital upgrades by controlling the customer’s use of the grid through interruption or load limiting equipment. The lower costs to serve such a class of customer could appropriately be reflected in a lower standby rate.

However, it is important to point out that the addition of on-site or local generation does not always add to distribution system costs. Indeed, in cases where the capacity of the delivery network to serve the load is constrained, the addition of properly situated and controlled on-site generation can actually reduce the costs of the distribution system. Mass. Electric’s distributed

resources pilot program in Brockton is an effort to quantify the value of these distributed resources in planning for distribution system reliability.

#### Appropriate Recovery of Costs Imposed by Self-Generating Customers

The design of a standby rate for customers with on-site generation that could potentially benefit the distribution system and for on-site generation that provides no such benefits requires a careful assessment of customer and distribution system requirements. Customers with distributed generation can provide value to the utility under various scenarios. However, there can be no losing sight of the fact that customers make decisions based upon their own needs and not that of the utility. A customer switches on lights for the purpose of illumination and does not think to check back with Mass. Electric. That scenario is the fundamental nature of the customer's business and the Company's obligation to serve.

#### Rates for Customers Who Impose Costs, Not Value

A customer with on-site generation who requests instant-on reliability should be assessed a full cost-based distribution rate for its total distribution service needs (both actual delivered and generated capacity and energy). In essence, such a customer is requesting Mass. Electric to reserve capacity for 100 percent of the customer's potential maximum load and energy delivery. This customer wants access to electricity at any time without restrictions and, as described above, must be included in the planning process based upon extreme conditions because of the probability that load may materialize instantly. Since these customers are like any similarly situated customers without generation, they should pay their appropriate share of costs for the

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<sup>6</sup> Several utilities offer interruptible or limited service standby tariffs. See, e.g., Arizona Public Service Company, Electric Service for Partial Requirements Service, Tariff A.C.C. Nos. 5470, schedule E-55, and 5510, schedule E52; Baltimore Gas&Electric Company, Standby for

distribution system that serves their needs in order to avoid the costs being shifted to other customers. Charging distribution rates based on the sum of the monthly generation and delivered - use to customers who want instant access to the grid is a fair and equitable rate design policy for all customers, including those with generation. As noted above, distribution planners design the system by considering customers' peak load requirements and their affect on the local distribution grid. Customers are charged their actual usage on average rates that are designed to recover the average cost of building, operating and maintaining the system that serves all customers at peak load. Customers can save money on those charges by reducing use, which actually lessens the need for new capacity and maintenance over time. The diversity of customer loads, both internal to the customer and external among customers, provides a sharing of this diversity benefit among all customers. By charging self-generating customers based on the total use in their facilities, the costs of the facilities built to serve those and other customers would be shared fairly. In addition, it would give proper market signals to customers with self-generation, who would appropriately shutdown their generation to take advantage of market prices.

In the future, customers with self-generation do have choices available to them that are unavailable to other customers. These choices could provide the customer with the ability to conserve resources on the distribution grid by requesting different levels of service. For example, a customer with self-generation may not require complete backup of their facilities. A customer with on-site generation may also allow the utility control over how quickly or for which periods the customer could access the distribution system in exchange for a discount off the full cost-based rate. Three levels of service could be provided to the customer in this scenario. In the first instance, a customer could agree to a delayed access of anywhere from a couple of hours to a couple of days, depending on the conditions. A second option could be allowed for customers

who want to schedule their delivery needs in advance in return for an even lower price for distribution service. Third, the customer could agree to interruptible Standby Service, allowing the utility to interrupt distribution service during peak or constrained periods, after notice is provided by the utility to the customer. Finally, customers have the right to completely separate from the distribution grid and serve their load through self-generation only. For services that schedule, delay or interrupt access to the grid, certain protections should be implemented to guard against a customer with on-site generation moving from a reduced level of standby service to full, 100% standby service without the appropriate level of compensation or notice to the utility. Essentially, it may be possible for the utility to provide customers with on-site generation a menu of options that would provide varying degrees of economic incentive to the customer while at the same time preventing cross-subsidies among customers with no on-site generation. Such protections would also insure against the arbitrage of utility-supplied commodity service versus operating on-site generation.

Mass. Electric does not propose that a customer with self-generation should pay for reservation of capacity based upon demand ratchets or contract demands. Mass. Electric believes these types of rates could be used in the design of standby rates for distribution service if they also applied to all similarly situated customers. Mass. Electric's proposal to bill customers on their actual use and generation in a month is more expensive to administer than a contract demand or demand ratchet, due to the requirement to meter the generation output of the customer, however, it does provide a fair and equitable means of allocating system costs in the absence of such demand charges. If the Department wishes to implement a rate that uses demand ratchets or contract demands, Mass. Electric reserves the right to provide comments to the Department on that rate design at the appropriate time.

### Proposed Rate Design for Generation that Improves Reliability

Currently, Mass. Electric has a pilot program in the Brockton area to test whether distributed resources can provide reliability benefits in return for compensation from the Company (“Brockton Pilot”). The Company is paying customers 50 cents per kWh for every kWh removed from the distribution grid at the time of a local peak. Participating customers can use many methods to comply, and distributed generation is one of them. Mass. Electric believes that its proposed credit calculation is an appropriate reflection of the savings and risks to the Company from the use of distributed resources. However, a purpose of the Brockton Pilot is to test these assumptions.

In the Brockton Pilot, the credit paid to customers is determined from the value of deferring an investment for five years. The deferral value is based on the estimated financing savings to Mass. Electric from not spending money sooner to address the projected load growth in the Brockton area. As approved by the Department, the deferral value is shared equally between customers and the Company. The pilot and its methodology are explained more thoroughly in the filing to the Department which is included in these comments as Exhibit 4. As explained, the value provided by the distributed resource exists only as long as the distribution investment can be deferred. To the extent that distributed generation can provide demonstrated and reliable deferral benefits, a similar, location-specific credit-based means of encouraging beneficial distributed generation projects may be appropriate.

### Standby Tariffs of Other Utilities

The Company has reviewed the standby tariffs in effect at a number of utilities in other states. Several of the tariffs the Company reviewed have a number of features in common. For example, a number of tariffs provide for standby service to be based on contracted demand reservations. See, e.g., Arizona Public Service Company, Electric Service for Partial Requirements Service, Tariffs A.C.C. Nos. 5510, Sch. E-52, and 5470, Sch. E-55; PECO Energy Company, Tariff Electric Pa. P.U.C. No. 3; West Penn Power Company, Tariff Electric Pa. P.U.C. No. 39, Supp. No. 140. To the extent customers' actual standby service requirements exceed their contracted requirements, the tariffs provide for additional charges to be assessed to the customer.

In Rhode Island, the standby service charges for Mass. Electric's affiliate, The Narragansett Electric Company ("Narragansett Electric"), are based on the total kW and kWh use at a customer's facility, including those generated by the customer's on-site generation, which the Company meters.<sup>7</sup> See The Narragansett Electric Company, Back-Up Service Rate, Tariffs R.I.P.U.C. No 1129 (B-02), R.I.P.U.C. No. 1130 (B-06), R.I.P.U.C. No. 1131 (B-32), and R.I.P.U.C. No. 1132 (B-62). Other companies also use the metered output of the customer's generation to determine monthly standby charges. See, e.g., Arizona Public Service Company, Electric Service for Partial Requirements Service, Tariffs A.C.C. Nos. 5510, Sch. E-52, and 5470, Sch. E-55.

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<sup>7</sup> Under the provisions of Narragansett Electric's Back-Up Service tariffs, if, for any reason, Narragansett Electric is unable to meter the generator's output, the customer may be charged based on the output of the generator assuming maximum possible capability at a 100% load factor.

The New York Public Service Commission recently approved new Standby Service Rates for Niagara Mohawk Power Corporation. Under these standby tariffs, customers are assessed a monthly contract demand charge and a daily as-used demand charge. See Niagara Mohawk Power Corporation, PSC No. 207 Service Classification No.7 - Sale of Standby Service to Customers with On-Site Generation Facilities. The monthly contract demand charge is designed to recover the costs for the local distribution facilities while the daily as-used demand charge is designed to recover the cost for the shared facilities. The shared facilities reflect primarily transmission facilities with a portion of the distribution system while the local distribution facilities relate to remaining distribution facilities and the customer service facilities.

Other utilities' standby tariffs allow customers to take either firm or interruptible standby service, and provide for the installation of load limiting devices in the case of the interruptible service to assure the customer does not exceed its standby service allotment. See, e.g., Baltimore Gas & Electric Company, Tariff P.S.C. Md. E-6 (Supp. 335). Some companies base their standby rates on the demonstrated capacity factor of the customer's generation, and allow the customer to designate the hours in the month during which it would take standby service (with a surcharge if such schedule is not followed). Arizona Public Service Company, Electric Service for Partial Requirements Service, Tariffs A.C.C. Nos. 5510, Sch. E-52, and 5470, Sch. E-55. Still other utilities provide customers with credits for each kW that the customer specifies as interruptible backup load (with the non-interruptible portion charged the full backup rate). Metropolitan Edison Company, Tariff Electric Pa. P.U.C. No. 35. Arizona Public Service Company's standby tariffs also allows for a negotiated discount from the monthly reservation (kW) charges if the customer can demonstrate that the utility's rates are not competitive with the customer- installed standby resource alternatives. See Arizona Public Service Company, Electric

Service for Partial Requirements Service, Tariffs A.C.C. Nos. 5510, Sch. E-52, and 5470, Sch. E-55.

Although the Company has not performed an exhaustive review of standby tariffs for other utilities outside of Massachusetts, the above discussion identifies several utilities that are allowed to recover their infrastructure investment (either distribution only or both distribution and transmission) required in order to be ready to provide service to customer's with on-site generation when that on-site generation is not in operation. These standby tariffs reflect commonality in their design (charges based on contract demand and actual usage) and allow flexibility in their application from the ability to provide interruptible standby service.

**3. Please discuss the role of distributed generation with respect to the provision of reliable, least cost distribution service by the Massachusetts distribution companies.**

The role of distributed generation in the provision of distribution service depends on several factors, including: the location of the generation, the ability to rely upon and control the generation, and the cost. If the generation resource is not reliable and consistently operating, it is not a good substitute for distribution capacity and thus has little value in planning and operating the distribution system. Nevertheless, distributed generation that is consistently available and reliable, is appropriately located, and is cost-effective, may be a valuable distribution system planning tool.

The principal role for distributed generation in distribution system planning is to allow the utility to cost-effectively defer or reduce investment in local distribution system facilities that would otherwise be needed for load growth. Load growth on the distribution system can be very non-uniform. In some locations, load growth might be very rapid (e.g., due to a new subdivision development or commercial park), whereas it may be slower and more predictable in other areas.

In high growth areas, distributed generation is generally not a feasible alternative to traditional distribution infrastructure solutions for meeting system needs. It is in the latter situations (i.e., slower, more predictable growth) where distributed generation has the greatest potential to provide benefits to the distribution system.

In cases of relatively slow load growth, the initial need for additional distribution capacity may be limited to a small number of peak periods for a limited number of days during the year. The incremental nature of this normal type of load growth, combined with the typically “lumpy” nature of capacity additions from new distribution investments, can result in under-utilization of new distribution capacity in the early part of its life cycle. Reliable distributed generation may be used to temporarily offset these incremental capacity demands that would appear early in the life cycle, thus allowing deferral of some distribution investments until they can be more fully and efficiently utilized. Such deferrals made possible by distributed generation might also provide the utility with added flexibility in scheduling and planning distribution system improvements and could provide other benefits as well. A more complete description of the benefits that might be derived from appropriately located and operated distributed generation (or other distributed resources) is contained in the testimony of Peter T. Zschokke, included in Exhibit 4.

Mass. Electric does currently consider distributed generation in its distribution system planning process. However, the issues surrounding the use of distributed generation as a planning tool are complex and variable, and therefore the Company has not yet implemented distributed generation as a distribution resource in any part of its system.<sup>8</sup> In order for a utility to incorporate distributed generation into its distribution system planning process, it must consider such things as:

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<sup>8</sup> However, as previously discussed, the Company hopes its BrocktonPilot will provide insight on how distributed resources can play a greater role in distribution system planning.

- Control;
- Availability;
- Reliability;
- Location and Timing;
- Costs;
- Safety; and
- Environmental Considerations;

Control. The principal consideration here is whether the utility has control over the operation of the distributed generation so it will be operating when it is needed. If it does not, then the generation cannot be relied upon for planning purposes. Means of achieving such control may be through contract, through system protection configurations (e.g., relaying, etc.), or through direct ownership.<sup>9</sup> The inability to control a customer's on-site generation precludes the consideration of those resources as distribution planning tools.

Availability – Clearly, distributed generation may serve as a short-term substitute for a distribution investment only if the resource is available when it is needed. If it is not available, then it has no value. In considering the reasonableness of using distributed generation as a substitute for a highly available distribution infrastructure solution, it is necessary to consider the reliability performance of particular generation technologies, as well as whether there is sufficient generation diversity to assure that loss of some generation does not jeopardize the distribution system.

Reliability – Because distributed generation is, by definition, located closer to end-use customers, its operation can have greater effects on the operation of the distribution system serving local customers than would central station generation. To avoid or limit adverse effects to other customers from the operation of the distributed generator, it may be necessary to invest in additional distribution equipment. For example, it may be necessary to install enhanced switching

devices to control voltages so that local generation coming on-line or off-line does not adversely affect power quality or delivery to other customers. Additional relaying will be required for power flow in multiple directions in cases where there is a net output to the system from the on-site generation.

Location and Timing – Location and timing are critical in assessing the value and distribution benefits of on-site generation. The greatest benefit of distributed generation in distribution planning would likely be achieved by focusing on high-cost areas (such as urban underground areas) where short load peaks are expected; typical costs for building utility distribution plant vary from \$50/kW to \$1,200/kW, with the highest cost areas being underground construction. Distributed generation might also be valuable as a planning tool at sites with limited immediate substation expansion potential. In these situations, distributed generation could provide a substitute for immediate capacity expansion as long as sufficient space could be found at customer locations.

Costs – The costs of any proposed distributed generation measure should be compared to the value of deferring the distribution investment for the proposed deferral period. The value of deferring an investment will vary with the circumstances, and could range from being quite significant to quite small. Typically, the maximum value that the utility would perceive from a distributed generation investment would be the time-value of the deferred distribution investment. (See the Testimony of Michael D. Laflamme contained in Exhibit 4). Offsetting the costs of the distributed generation project (which include the costs of interconnection, control equipment, relaying, fuel, operation, etc.) would be any economic benefit the generation owner derives from

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<sup>9</sup> Because Mass. Electric and its affiliates have affirmatively decided to exit the power generation and supply function, the direct ownership of distributed generation has not been actively pursued.

operating the unit (e.g., avoided power purchases, revenues from power sales, contract revenues, etc.).

Safety – Paramount in the planning of the distribution system is safety. Processes and requirements to assure that distributed generation is safely incorporated into the distribution system therefore are essential. Comprehensive and complex relaying schemes to assure faults are cleared quickly to insure personnel and public safety would be necessary. These types of relaying schemes are not usually found on local distribution feeders that do not have distributed generation.

Environmental Considerations – Compared to traditional wires solutions, fossil-fired distributed generation may have a greater environmental impact and may raise many local environmental concerns. Furthermore, uncertainty in the environmental landscape could impact the future operability of some on-site resources.

**a. What steps should the distribution companies take in order to identify areas where the installation of distributed generation would be a lower-cost alternative to system upgrades and additions?**

Assuming the issues that limit the use of distributed generation as a planning tool (discussed in the previous section) can be successfully addressed, there are a number of steps a utility can take to identify areas where distributed generation might be a potential system planning resource. First, the distribution system planner can identify those areas on the system where the demand due to load growth is expected to exceed the capacity of the local distribution system in the near future, but where the pace of growth is such that added distribution capacity may not be highly utilized in the early years of the life cycle. (As mentioned previously, areas where load growth rates are very high are not considered good candidates for distributed generation alternatives).

For the areas identified, the distribution system planners can then estimate what the cost of the distribution capacity addition might be. The variability in the cost of adding distribution capacity can be substantial. Clearly, if a capacity addition can be implemented at a relatively low cost, there is little value to deferring such a project by installing distributed generation. However, if the proposed distribution infrastructure solution is relatively expensive, or would for some other reason take longer to implement than a distributed generation solution, the use of distributed generation to defer the proposed distribution infrastructure solution may be appropriate. Based on the estimated cost of the capacity addition and the estimated rate of local load growth, one could estimate the value of deferring the distribution system investment.

Distribution system planners would also need to determine whether a particular area is appropriate for a distributed generation solution. For example, environmental considerations may limit the ability to install distributed generation with the requisite performance characteristics. Also, the power quality needs of other customers, or the configuration of the distribution system in the area (e.g., radial versus network), could limit the usefulness of distributed generation or could require the installation of expensive distribution protection and control equipment to preserve system performance. Planners should also focus on potential projects with a sufficient lead-time (e.g., 2-3 years) to allow time for permitting and construction. Finally, an identification of areas where distributed generation might be appropriate would need to include a risk assessment of the effect of the system needs disappearing before the generation is built (e.g., a large customer closes or relocates its facility) or if the local load growth far exceeds forecasts (e.g., a large development is built) and cannot be properly served with the distributed generation.

Once the areas where distributed generation could be incorporated into distribution planning are identified, distribution system planners could set forth the criteria or requirements

that a distributed generation project would have to satisfy in order to be a suitable solution enabling the deferral of distribution investment. For example,

- System Voltage: The voltage to which the distributed generation will be expected to interconnect.
- Peak Supply: The amount of generation required by a target date.
- Voltage Range: Voltage regulation requirements.
- Power Factor: The distributed generation installation should operate within a specific power factor range and be capable of both absorbing and generating VARs (volt-amperes reactive).
- Required Operation: The expected periods and duration of operation (including maintenance parameters) for the distributed generation to serve as a short-term substitute for distribution.
- Availability: The aggregate availability for the generation must be extremely high to serve as a reliable substitute to a traditional distribution solution. This level of availability could be at the feeder level, need not be on a unit-by-unit basis, and may necessitate distributed generation solutions to consist of multiple units to achieve such availability.
- Dispatchability: The distributed generation must be capable of operating at its required level within 30 minutes of the time called.
- Communications: Appropriate communications arrangements will be required, both for metering and operational control.

Other contractual and technical issues in addition to those shown above also would need to be resolved. If in the future there is a sufficient amount of distributed generation operating on the distribution system, some aspects of diversity could enable the potential relaxation of some of the technical criteria.

In the Company's annual review of future distribution system needs, if a deferral potential is possible, a deferral value as well as technical needs and criteria could be determined.

**b. What steps should the distribution companies take to encourage the installation of cost-effective distributed generation in their service territories?**

The economics associated with the installation of cost-effective distributed generation will depend on many factors that will generally be specific to the generation owner. These include the cost of buying energy from the market versus the cost of self-generation and the customer's desire

for a back-up supply for its own load. Considerations relating to distribution service, although important, are not necessarily the driving consideration influencing a party's decision whether or not to install distributed generation. In addition, the value provided to the distribution system by distributed generation will vary depending on location, and typically will be limited to the deferral value of the distribution system investment that can be delayed.<sup>10</sup> Therefore, to the extent that the utility may provide financial support to "encourage" installation of cost-effective distributed generation, such support should be no more than the benefit conferred by the generation on the distribution system. Given the potential for other revenue streams (e.g., host sales of energy, avoid purchases, etc.), distributed generation may be cost-effective irrespective of distribution-related benefits. To provide any artificially greater encouragement could produce undue cost shifting and send distorted market signals.

Utilities, subject to appropriate confidentiality protections, can also make available information regarding potential deferral values for certain larger planned distribution upgrades. Thus, in evaluating the economics of a possible distributed generation project, the project developer can consider such values as a potentially available benefit for the project. Developers and the utility can then determine whether a particular project would satisfy the distribution system needs for the desired period, and if so, attempt to develop a mutually satisfactory arrangement. Clarity with respect to the business and technical arrangement between the generation owner and the utility is critical. Finally, a utility can request proposals from developers for distributed generation options to fulfill distribution system needs. This approach is currently being piloted in New York on a limited basis.

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<sup>10</sup> Although called a "load curtailment" program, the Brockton Pilot provides just such benefits for customers that reduce their loads on the distribution system when requested, even if such load reduction is the result of the operation of on-site generation.

**4. What other issues are appropriate for consideration as part of the Department's investigation of distributed generation?**

There are many issues that should be considered when addressing distributed generation in the larger context. One thing that is clear from the preceding discussion is that the existing distribution system was not originally designed for the broad application of distributed generation. Rather, it was designed to reliably serve customer loads through the delivery of central station power. As the penetration of distributed generation increases and the central station paradigm changes, the manner in which the distribution system is designed and operated will also need to change. Although distributed generation may enable deferred or reduced investments in distribution infrastructure in some cases, it also may result in the need for greater investment in others. The changes to the distribution system necessitated by the introduction of greater levels of distributed generation, and the design of distribution standby rates to avoid undue cost-shifting need to be addressed.

Another issue (discussed in prior sections of these comments) is the level of “encouragement” (if any) that distributed generation should receive. While these comments focus on the benefit that distributed generation may bring to the distribution system, such generation also could bring benefits in the energy markets, particularly as the markets transition to locational marginal pricing. In most instances, the lion’s share of the benefits of distributed generation will be at the host sites; however, other customers in an area that hosts distributed generation also may benefit from lower energy prices due to the on-site generation owned and operated by their neighbor. Such benefits would not be related to the “distribution” aspect of a distributed generation project, but rather to the energy aspect of it. It may be appropriate to consider whether there is a way to value the benefit that a distributed generation project may provide to other customers.

The Department also should recognize that distributed generation resources differ greatly in cost and technology.<sup>11</sup> These differences will affect whether a particular distributed generation solution is appropriate for a particular need.

The Department also should consider, what effect, if any, the FERC's efforts regarding the Standardization of Generator Interconnection Agreements and Procedures, FERC Rulemaking Docket No. RM02-1-000, may have on the interconnection of distributed generation. In its notice of proposed rulemaking issued April 24, 2002, the FERC proposed that FERC jurisdictional interconnection agreements and interconnection procedures would apply for generators that interconnect at the distribution level if the output from that generator is to be sold at wholesale. FERC Docket RM02-01, NOPR at 14-15. National Grid filed initial comments with the FERC in mid-June requesting that FERC give careful consideration to the appropriateness of regulating matters traditionally addressed at the state level. FERC also recently announced its intention to initiate another rulemaking entitled: Standardization of Small Generator Interconnection Agreements and Procedures, Docket No. RM02-12-000. Such a rulemaking clearly could affect the interconnection of distributed generation in Massachusetts. Mass. Electric intends to review carefully the FERC's rulemaking proposal and participate accordingly.

Although these comments focus on distributed generation, other distributed resources -- such as demand response initiatives -- can be effectively used to manage loads. Mass. Electric has a long history with the implementation of demand side management measures that have yielded long-term and consistent load relief. Additionally, the Company's Brockton Pilot is designed to test the viability of demand response as a distribution system planning tool. As of the date of this filing, two interruptions under the Brockton Pilot program have been called. Initial

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<sup>11</sup> Distributed generation units can range in cost from \$400/kW to \$4,000/kW installed (low price represents diesel engine set, high price represents either fuels cells or solar). Such technologies also have very different environmental impacts. Similarly, the intermittent power output

results indicate that customers performed as planned and provided the requested load reductions. If the Brockton Pilot produces promising results, expansion of load response programs may be advisable. Upon the identification of a distribution system need with substantial deferral value, a utility could work with local customers to perform comprehensive load shed audits that would highlight the extent of demand response that may be feasible. Working to help customers better understand their own energy needs will enable them to manage their loads better, and to participate more meaningfully in future demand response initiatives. Because demand response programs are much less costly to implement than capital-intensive distributed generation, and because they require fewer system protection investments, and do not raise any potential jurisdictional complexities, the Department should consider supporting the use of properly structured demand response programs as a distribution system planning tool.

## **Conclusion**

The proper integration of distributed generation into the distribution system involves a great number of complex and varying considerations. Distributed generation can, in some cases, provide valuable benefits to the distribution system. In other cases, however, it can provide no (or even negative) value to the system. Utilities should not erect unfair barriers to distributed generation, but by the same token, utilities or their other customers should not be required to subsidize distributed generation. Customers with distributed generation installations should pay their fair share of distribution system costs that are properly attributable to them. Utilities should be encouraged to identify and share the demonstrated value derived from specific distributed generation installations; provided, however, that the determination of such value must be made on an installation-specific basis.

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of solar and wind may affect their availability performance.

Respectively submitted,

MASSACHUSETTS ELECTRIC COMPANY  
NANTUCKET ELECTRIC COMPANY  
By their attorneys,

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Massachusetts Electric Company  
Nantucket Electric Company  
D.T.E. Docket No. 02-38

Exhibit 1

Interconnection Requirements Document for Customer-Owned Generating  
Facilities

M.D.T.E. No. 1052

## **INTERCONNECTION REQUIREMENTS DOCUMENT CUSTOMER-OWNED GENERATING FACILITIES**

### **1.0 Preamble**

This document (“Interconnection Requirements Document”) describes the process and requirements for a customer to connect a Facility, as defined herein, to the Company’s Distribution System.

The process and requirements contained herein are applicable to all Facilities interconnecting with the Company’s Distribution System including Qualifying Facilities, as defined in 220 CMR 8.02, and On-Site Generating Facilities, as defined in 220 CMR 8.02.

The process and requirements contained herein are not applicable to portable emergency generators. Such generators must be installed in accordance with Article 700 of the National Electrical Code and Article 310 of the National Grid USA publication Information and Requirements for Electric Service Handbook in such a manner as to ensure that the generator cannot be operated in parallel with the Company’s Distribution System. Attempting to interconnect a generator of this type with the Company’s Distribution System, except as specified above, can cause significant damage to the Company’s Distribution System and catastrophic damage to the Interconnecting Customer’s generator and premises.

The Company will work closely and promptly with any customer who desires to install a Facility.

### **2.0 Definitions**

The following words and terms shall be understood to have the following meanings when used in this Interconnection Requirements Document:

**Affiliate:** Any company that is a subsidiary of National Grid USA.

**Company:** Massachusetts Electric Company or Nantucket Electric Company, as applicable.

**Department:** The Massachusetts Department of Telecommunications and Energy

**Designated Agent:** Any entity that performs actions or functions on behalf of the Company or the Interconnecting Customer required under this Interconnection Requirements Document and/or the Exhibits hereto.

**Distribution Facilities Upgrades:** Modifications or additions to distribution-related facilities that are integrated with and support the Company's Distribution System for the benefit of the Interconnecting Customer.

**Distribution Facilities Impact Study:** The first phase of engineering study conducted by the Company to determine the required modifications to its Distribution System, resulting in study grade cost estimates (+/- 25%) and an approximate estimate of the time required for such modifications that will be required to provide the requested interconnection service. The Distribution Facilities Impact Study is not suitable for finalizing agreements, contracts or commitments.

**Distribution Facilities Detailed Study:** The final phase of engineering study conducted by the Company to determine the required detailed modifications to its Distribution System, resulting in project grade cost estimates (+/- 10%) and an estimate of the time required for such modifications that will be required to provide the requested interconnection service.

**Distribution Facilities Upgrades Charge:** A charge to be paid by an Interconnecting Customer equal to all costs associated with the upgrade or modification of the Distribution System for safe interconnection of the Facility with the Company's Distribution System.

**Distribution System:** The facilities owned, controlled or operated by the Company that are used to provide distribution service to its customers.

**Facility:** A customer-owned source of electricity, which may be an Inverter or a rotating generator of the synchronous or induction type and all facilities ancillary and appurtenant thereto, which the Interconnecting Customer requests to interconnect to the Distribution System.

**Good Utility Practice:** Any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to

accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted in the region.

**In-Service Date:** The date on which the Facility and Distribution Facilities Upgrades (if applicable) are complete and ready for service, even if the Facility is not placed in service on or by that date.

**Interconnecting Customer:** A customer desiring to install an independently-operated Generating Facility, which is interconnected with the Company's Distribution System.

**Interconnection Service Agreement:** An agreement for interconnection service, the form of which is provided in Exhibit 2, between the Interconnecting Customer and the Company. The agreement also includes any amendments or supplements thereto entered into by the Interconnecting Customer and the Company.

**Inverter:** An electrical device that accepts direct current as input, and produces alternating current as output.

**ISO-New England:** The Independent System Operator established in accordance with the New England Power Pool ("NEPOOL") Agreement, which is responsible for managing the bulk power generation and transmission systems in New England.

**Metering Point:** For meters that do not utilize instrumentation transformers, the point at which the billing meter is connected. For meters that utilize instrumentation transformers, the point at which the instrumentation transformers are connected.

**Network Distribution System:** Electrical service where two or more distribution transformers have their secondary windings connected in parallel to form a network of conductors supplying service voltage to customers. Primary voltage to the transformers may come from a number of independent circuits, so that loss of one primary circuit will not generally cause a loss of service voltage to customers.

**Notice of Intent to Interconnect:** Notice provided by Interconnecting Customer to the Company, the form of which is shown in Exhibit 1, which initiates the interconnection process.

**On-Site Generating Facility:** A class of customer-owned generating facilities with peak capacity of 60 kW or less, as defined in 220 CMR 8.02.

**Parties:** The Company and the Interconnecting Customer.

**Policy and Practices for Protection Requirements for New or Modified**

**Interconnections:** The Company's policy concerning protection requirements for new or modified interconnections to power sources, which is included in Exhibit 3 to this Interconnection Requirements Document and attached and incorporated by reference.

**Point of Delivery:** A point on the Company's Distribution System where the Interconnecting Customer makes capacity and energy available to the Company. The point of Delivery shall be specified in the Interconnection Service Agreement.

**Point of Receipt:** A point on the Company's Distribution System where the Company delivers capacity and energy to the Interconnecting Customer. The Point of Receipt shall be specified in the Interconnection Service Agreement.

**Qualifying Facility:** A generation facility that has received certification as a Qualifying Facility from the Federal Energy Regulatory Commission in accordance with the Federal Power Act, as amended by the 1978 Public Utilities Regulatory Policies Act, as defined in 220 CMR 8.02.

**Radial Distribution System:** Electrical service from a system consisting of one or more primary circuits extending from a single substation or transmission supply point arranged such that each primary circuit serves customers in a particular local area.

### 3.0 Process Overview

The process of interconnecting a Facility with the Company's system is as follows:

- a. The Interconnecting Customer submits a Notice of Intent to Interconnect ("Notice of Intent") to the Company. The information that is required to be provided in the Notice of Intent is provided in Exhibit 1. Such notice shall be sent to:

Massachusetts Electric Company  
55 Bearfoot Road  
Northboro, MA 01532  
Attn: Senior Vice President – Business Services

- b. Upon receipt of the Notice of Intent, the Company will assign an Account Manager to work with the Interconnecting Customer and serve as the point of contact for all future activities. The Notice of Intent will be reviewed for completeness and to verify that the request is for an interconnection to the Company's Distribution System. In addition, if the Notice of Intent is for an Inverter-based Facility, the Company will determine if the Facility complies with UL Standard 1741. If any of these requirements are not met, the Interconnecting Customer will be provided written notice and the application process will be suspended until the Interconnecting Customer has remedied any deficiencies.
- c. Upon verification and within 45 days of the Company's receipt of the Notice of Intent, the Company will conduct an initial site inspection of the proposed Facility to determine if a Distribution Facilities Impact Study is required. If a Distribution Facilities Impact Study is not required and the Facility meets the requirements for immediate interconnection to the Company's system, the Interconnecting Customer and the Company shall execute an Interconnection Service Agreement, the form of which is provided in Exhibit 2, and the Interconnecting Customer shall pay the Company the amount specified in such agreement. In some cases, the Company may determine that a Distribution Facilities Impact Study is not required and may proceed directly with a Distribution Facilities Detailed Study.
- d. If a Distribution Facilities Impact Study is required, the Company will prepare a cost estimate to perform a Distribution Facilities Impact Study and will submit such estimate to the Interconnecting Customer. For a Distribution Facilities Impact Study involving a Qualifying Facility or On-Site Generating Facility, the Company will provide the estimate within 45 days of the Company's receipt of the Notice of Intent.
- e. If the Interconnecting Customer elects to proceed with the Distribution Facilities Impact Study, the Interconnecting Customer and the Company shall execute a Distribution Facilities Impact Study Agreement, the form of which is provided in

Exhibit 4, and the Interconnecting Customer shall pay the Company the amount specified in such agreement.

- f. Upon execution of the Distribution Facilities Impact Study Agreement and receipt of payment in full, the Company will conduct the Distribution Facilities Impact Study and upon completion of the work issue a Distribution Facilities Impact Study Report to the Interconnecting Customer. A Distribution Facilities Impact Study involving a Qualifying Facility or On-Site Generating Facility will be completed within 90 days of the Company's receipt of the executed Distribution Facilities Impact Study Agreement and payment in full or such later date as agreed to between the Company and the Interconnecting Customer.
- g. If a Distribution Facilities Detailed Study is required and the Interconnecting Customer elects to proceed with such study, the Company will prepare a cost estimate to perform a Distribution Facilities Detailed Study and will submit such estimate to the Interconnecting Customer. For a Distribution Facilities Detailed Study involving a Qualifying Facility or On-Site Generating Facility, the Company will provide the estimate (i) within 45 days of the Company's receipt of the Notice of Intent, if a Distribution Facilities Impact Study is not required, or (ii) at the conclusion of the Distribution Facilities Impact Study, if a Distribution Facilities Impact Study is performed.
- h. If the Interconnecting Customer elects to proceed with the Distribution Facilities Detailed Study, the Interconnecting Customer and the Company shall execute a Distribution Facilities Detailed Study Agreement, the form of which is provided in Exhibit 5, and the Interconnecting Customer shall pay the Company the amount specified in such agreement.
- i. Upon execution of the Distribution Facilities Detailed Study Agreement and receipt of payment in full, the Company will conduct the Distribution Facilities Detailed Study and upon completion of the work issue a Distribution Facilities Detailed Study Report

to the Interconnecting Customer. A Distribution Facilities Detailed Study involving a Qualifying Facility or On-Site Generating Facility will be completed within 90 days of the Company's receipt of the executed Distribution Facilities Detailed Study Agreement and payment in full or such later date as agreed to between the Company and the Interconnecting Customer.

- j. If, upon receipt of the Distribution Facilities Detailed Study Report, the Interconnecting Customer elects to proceed with the construction of facilities to interconnect the Facility the Interconnecting Customer and the Company shall execute an Interconnection Service Agreement and the Interconnecting Customer shall pay the Company the amount specified in such Agreement. If the Interconnecting Customer is a Qualifying Facility or an On-Site Generating Facility and does not agree with the Company's cost estimate, the Interconnecting Customer or the Company may petition the Department to review the reasonableness of the Company's cost estimate.
- k. Upon execution of the Interconnection Service Agreement and receipt of payment in full, the Company will construct the required facilities.

#### **4.0 Basic Understandings**

The Interconnecting Customer intends to install a Facility on the Interconnecting Customer's premises. This power source will be connected electrically to the Company's Distribution System and operate in synchronism with the voltage and frequency maintained by the Company during normal operating conditions. The interconnection of the power source with the Company's Distribution System must meet the technical requirements of this Interconnection Requirements Document and may require an upgrade or other modifications to the Distribution System in order to meet such requirements. Subject to the requirements contained in this Interconnection Requirements Document, the Company or its Affiliate shall, at Interconnecting Customer's expense, modify the Distribution System accordingly.

#### **4.1 Facility Classification**

The interconnection requirements for a Facility or Inverter are dependent on its capacity and the type of power production technology utilized.

To determine the requirements for a given Facility, the following Categories and Types have been established:

| Categor<br>y | Maximum Output (kW)      |
|--------------|--------------------------|
| 1            | $\leq 10$                |
| 2            | $> 10$ and $\leq 60$     |
| 3            | $> 60$ and $\leq 300$    |
| 4            | $> 300$ and $\leq 1,000$ |
| 5            | $> 1,000$                |

| Type | Technology                             |
|------|--|
| A-1  | Inverter-based, single phase           |
| A-3  | Inverter-based, three phase            |
| B-1  | Induction generator, single phase      |
| B-3  | Induction generator, three phase       |
| C-1  | Synchronous generator, single<br>phase |
| C-3  | Synchronous generator, three phase     |

Tables 1-A and 1-B provide an overview of the applicable interconnection requirements for Category 1, 2, 3 and 4 Facilities. Category 5 Facilities are subject to the full extent of requirements contained in this Interconnection Requirements Document

**TABLE 1A**  
**OVERVIEW OF INTERCONNECTION REQUIREMENTS**

| Category 1 Facilities |   |  |              |                                      |
|-----------------------|---|--|--------------|--------------------------------------|
|                       | If Connected to Radial Distribution System* | If Connected to Network Distribution System* | Net Metering | Distribution Facilities Impact Study |
| Type A-1              | Requirement 1                               | Requirements 1 & 2                           | Allowed      | Not Required                         |
| Type A-3              | Requirement 1                               | Requirements 1 & 2                           | Allowed      | Not Required                         |
| Type B-1              | Requirement 3                               | Requirements 2 & 3                           | Allowed      | Required **                          |
| Type B-3              | Requirement 3                               | Requirements 2 & 3                           | Allowed      | Required **                          |
| Type C-1              | Requirement 4                               | Requirements 2 & 4                           | Allowed      | Required                             |
| Type C-3              | Requirement 4                               | Requirements 2 & 4                           | Allowed      | Required                             |

| Category 2 Facilities |   |   |              |                                      |
|-----------------------|---|---|--------------|--------------------------------------|
|                       | If Connected to Radial Distribution System* | If Connected to Network Distribution System | Net Metering | Distribution Facilities Impact Study |
| Type A-1              | Requirement 1                               | Requirements 1 & 2                          | Allowed      | Required (Note A)                    |
| Type A-3              | Requirement 1                               | Requirements 1 & 2                          | Allowed      | Required (Notes A & B)               |
| Type B-1              | Requirement 3                               | Requirements 2 & 3                          | Allowed      | Required (Note A)                    |
| Type B-3              | Requirement 3                               | Requirements 2 & 3                          | Allowed      | Required (Notes A & B)               |
| Type C-1              | Requirement 4                               | Requirements 2 & 4                          | Allowed      | Required (See Note A)                |
| Type C-3              | Requirement 4                               | Requirements 2 & 4                          | Allowed      | Required (Notes A & B)               |

\* Most distribution systems are radial in nature; however, network systems are employed in some urban areas. Contact the Company to determine whether the proposed Facility site is served by a Radial Distribution System or Network Distribution System.

\*\* The scope of the study is expected to be minimal.

Requirement. 1: The Inverter must comply with UL Standard 1741.  
A photovoltaic system must also comply with IEEE Standard 929-2000.

Requirement. 2: For installations in which the Facility minimum load is less than fifteen (15) times the peak output of the generating system, a reverse power flow relay will be required as part of the protection system. If the Facility minimum load is at least fifteen (15) times the peak output of the generating system, a reverse power flow relay will not be required.

Requirement. 3: The Facility must meet the protection requirements specified for induction generators as shown in Exhibit 3.

Requirement. 4: The Facility must meet the protection requirements specified for synchronous generators as shown in Exhibit 3.

Note A: If the Interconnecting Customer proposes to install a Facility with a capacity greater than 100% of the capacity of the distribution transformer providing site service, a Distribution Facilities Impact Study and Distribution Facilities Detailed Study would be required and an upgrade charge would apply.

Note B: If the Interconnecting Customer receives single-phase electrical service from the Company but desires to install a three-phase power Facility, a Distribution Facilities Impact Study and Distribution Facilities Detailed Study would be required and an upgrade charge would apply.

**TABLE 1B**  
**OVERVIEW OF INTERCONNECTION REQUIREMENTS**

| Category 3 Facilities |   |  |              |                                      |
|-----------------------|---|--|--------------|--------------------------------------|
|                       | If Connected to Radial Distribution System* | If Connected to Network Distribution System* | Net Metering | Distribution Facilities Impact Study |
| Type A-3              | Requirement 1                               | Requirements 1 & 2                           | Not Allowed  | Required (Note A)                    |
| Type B-3              | Requirement 3                               | Requirements 2 & 3                           | Not Allowed  | Required                             |
| Type C-3              | Requirement 4                               | Requirements 2 & 4                           | Not Allowed  | Required                             |

| Category 4 Facilities |   |  |              |                                      |
|-----------------------|---|--|--------------|--------------------------------------|
|                       | If Connected to Radial Distribution System* | If Connected to Network Distribution System* | Net Metering | Distribution Facilities Impact Study |
| Type A-3              | Requirement 1                               | Requirements 1 & 2                           | Not Allowed  | Required                             |
| Type B-3              | Requirement 3                               | Requirements 2 & 3                           | Not Allowed  | Required                             |
| Type C-3              | Requirement 4                               | Requirements 2 & 4                           | Not Allowed  | Required                             |

\* Most distribution systems are radial in nature; however, network systems are employed in some urban areas. Contact the Company to determine whether the proposed Facility site is served by a Radial Distribution System or Network Distribution System.

Requirement. 1: The Inverter must comply with UL Standard 1741.

Requirement. 2: For installations in which the Facility minimum load is less than fifteen (15) times the peak output of the generating system, a reverse power flow relay will be required as part of the protection system. If the Facility minimum load is at least fifteen (15) times the peak output of the generating system, a reverse power flow relay will not be required.

Requirement 3: The Facility must meet the protection requirements specified for induction generators as shown in Exhibit 3.

Requirement 4: The Facility must meet the protection requirements specified for synchronous generators as shown in Exhibit 3.

Note A: If the Interconnecting Customer proposes to install a Facility with a capacity greater than 100% of the capacity of the distribution transformer providing service to the site, a Distribution Facilities Impact Study and Distribution Facilities Detailed Study would be required and an upgrade charge would apply.

## **5.0 Construction of the Distribution Facilities Upgrades**

**5.1 General Considerations:** The Company or its Affiliate or another party selected pursuant to this section shall construct the Distribution Facilities Upgrades at the Interconnecting Customer's expense. The Company shall determine a schedule for construction and final interconnection. The Company shall use reasonable efforts to fulfill its obligations under this schedule in order to permit interconnection with the Facility in a timely manner. If the Company cannot interconnect a Qualifying Facility or On-Site Generating Facility within 90 days of the Company's receipt of the executed Interconnection Service Agreement and payment in full or such later date as agreed to between the Company and the Interconnecting Customer, that Interconnecting Customer or the Company may petition the Department to determine the time frame for the completion of the interconnection, in accordance with 220 C.M.R. 8.04(6)(a). The Company shall use, or specify that the selected contractor use, standard equipment customarily employed by the Company or its Affiliate for its own system in accordance with Good Utility Practice in making the final interconnection.

Pursuant to 220 CMR 8.04(3), the Interconnecting Customer also agrees to pay the Company for all reasonable costs and fees required to enable the Company to fulfill its obligations, including any tax liability, the costs and fees of all permits, licenses, franchises or regulatory or other approvals necessary for the construction and operation of the Distribution Facilities Upgrades and any facilities ancillary or appurtenant to them. The Company shall consult with the Interconnecting Customer on decisions involving substantial additional costs to be incurred by the Company in fulfillment of its obligations.

**5.2 QF Certification and Engineer's Report:** If the Interconnecting Customer is a Qualifying Facility, it shall provide the Company with proof that its facility has received certification as a Qualifying Facility from the Federal Energy Regulatory Commission in accordance with the Federal Power Act, as amended by the Public Utilities Regulatory Policies Act of 1978. Such proof shall be provided to the Company within the thirty (30) day period prior to the in-service date of the Facility. The Interconnecting Customer shall also provide the Company with notice of any change in its Qualifying Facility status within fifteen (15) days of any such change.

Further, within the thirty (30) day period prior to the In-Service Date, the Interconnecting Customer, at its expense, shall submit an independent engineer's report to the Company stating that it is reasonably projected that during the ten-year period, beginning with the year in which the Facility is placed in service, and, at the Interconnecting Customer's option, not including data from the first year of this ten-year period, no more than 5% of the total power flows (Athe 5% test≡ as defined by IRS Notice 88-129) over the interconnection to the Interconnecting Customer. Acceptance of this report shall be subject to the Company's review and concurrence. The Company may require that a second report be provided, at the Interconnecting Customer's expense, if the Company reasonably concludes that the first report is unreliable for purposes of anticipating the taxability of the services provided hereunder. In order to meet the requirements of IRS Notice 88-129 by March 1 of the year following the start of Interconnection Service, and annually thereafter, the Interconnecting Customer shall provide to the Company a report of the total bi-directional power flows over the interconnection during the previous calendar year.

The Interconnecting Customer agrees that payments to the Company hereunder will be deemed a contribution in aid of construction ("CIAC") and taxable to the Company if the Facility does not receive Qualifying Facility certification or the engineer's report concludes that the 5% test will not be met. In either event, the Interconnecting Customer agrees to pay the Company in advance for all taxes owed on the CIAC. Such payment shall be made within ten (10) days of notice from the Company of the estimated taxes owed, based on the Company's then effective gross-up factor times the amount of the CIAC. The Company may refuse final interconnection with the Facility until such payment is made.

**5.3 Land Interests:** The Interconnecting Customer recognizes that Distribution Facilities Upgrades may require acquisition of land interests, which may require individual agreements between the Company or its Affiliate and the landowners. The Interconnecting Customer agrees to pay to the Company all reasonable costs incurred by it or its Affiliate associated with these acquisition agreements in advance of their execution. The Company reserves the right to draft any and all documents creating land interests that it will receive to effectuate interconnection service under this Interconnection Requirements Document.

In the event the Interconnecting Customer acquires the land, permits, licenses, franchises or regulatory or other approvals necessary for the construction and operation of the Distribution Facilities Upgrades, the Company has the right, at Interconnecting Customer's expense, to approve or reject any terms and conditions related thereto prior to the start of service.

## **6.0 Distribution Facilities Upgrades Charge**

If Distribution Facilities Upgrades are required to accommodate installation of the Facility, the Interconnecting Customer shall be required to pay a Distribution Facilities Upgrades Charge. Such charge may be billed as an incremental monthly charge based upon the total costs of the facilities upgrade, with the total upgrade cost amortized over three years. The Interconnecting Customer also has the option of paying the total Distribution Facilities Upgrades Charge prior to interconnection. In the event that other customers of the Company are served by the upgraded facilities at the time the upgrade is implemented, the Interconnecting Customer shall pay its allocated share of the Distribution Facilities Upgrades Charge.

## **7.0 Delivery and Measurement of Electricity**

**7.1 Voltage Level:** All electricity across the Interconnection Point shall be in the form of single-phase or three-phase sixty-hertz alternating current at a voltage class determined by mutual agreement of the Parties.

### **7.2 Machine Reactive Capability**

**7.2.1 Category 1, 2, 3 and 4 Facilities:** Category 1, 2, 3 or 4 Facilities will not be required to provide reactive capability.

**7.2.2 Category 5 Facilities:** Each Category 5 Facility interconnected with the Company's Distribution System shall be required to provide reactive capability to regulate and maintain system voltage at the Interconnection Point. The Company and NEPOOL shall establish a scheduled range of voltages to be maintained by the

Facility. The reactive capability requirements shall be reviewed as part of the Distribution Facility Impact Study and Distribution Facility Detailed Study.

**7.3 Metering, Related Equipment and Billing Options:** The Company shall furnish, read and maintain all revenue metering equipment. Except as provided below, the Company shall own the meter and the Interconnecting Customer shall pay to the Company a monthly charge to cover taxes, meter maintenance, incremental reading and billing costs, the allowable return on the invoice cost of the meter and the depreciation of the meter. These charges are set forth in Schedule B of the Company's Qualifying Facility Power Purchase Rate P, M. D. T. E. No. 1032-C, as amended from time to time. If the Facility is a Qualifying Facility or On-Site Generating Facility the Interconnecting Customer may elect to own the meter, in which case, the Interconnecting Customer shall pay to the Company a monthly charge to cover meter maintenance and incremental reading and billing costs. These charges are set forth in Schedule B of the Company's Qualifying Facility Power Purchase Rate P, as amended from time to time.

The Interconnecting Customer shall provide suitable space within the Facility for installation of the metering, telemetering and communication equipment at no cost to the Company.

The Interconnecting Customer shall be responsible for purchasing and installing software, hardware and/or other technology that may be required by the Company to read billing meters.

All metering equipment installed pursuant to this Interconnection Requirements Document and associated with the Facility shall be routinely tested by the Company at Interconnecting Customer's expense, in accordance with applicable Company and/or ISO-New England criteria, rules and standards. If, at any time, any metering equipment is found to be inaccurate by a margin greater than that allowed under applicable criteria, rules and standards, the Company shall cause such metering equipment to be made accurate or replaced. The cost to repair or replace the meter shall be borne by the Company, if the Company owns the meter, or by the Interconnecting Customer if the Interconnecting Customer owns the meter. Meter readings

for the period of inaccuracy shall be adjusted so far as the same can be reasonably ascertained; provided, however, no adjustment prior to the beginning of the preceding month shall be made except by agreement of the Parties. Each party shall comply with any reasonable request of the other concerning the sealing of meters, the presence of a representative of the other party when the seals are broken and the tests are made, and other matters affecting the accuracy of the measurement of electricity delivered from the Facility. If either party believes that there has been a meter failure or stoppage, it shall immediately notify the other.

If the Metering Point and the Point of Receipt or Point of Delivery are not at the same location, the metering equipment shall record delivery of electricity in a manner that accounts for losses occurring between the Metering Point and the Point of Receipt or Point of Delivery. Losses between the Metering Point and Point of Receipt will be reflected pursuant to applicable Company, NEPOOL or ISO-New England criteria, rules or standards.

The type of metering equipment to be installed at a Facility is dependent on the Category (size) of the facility and how and to whom the net Facility output will be sold. The available equipment options and associated requirements are:

- Net Metering – in which a standard distribution class meter is installed and is enabled to run in a normal direction during periods of net consumption and to run backwards during periods of net generator output. All metering equipment included in this type of installation, including self-contained meters and instrument transformers and meters, shall meet ANSI C12.1 Metering Accuracy Standards and ANSI C57.13 accuracy requirements for instrument transformers.
- Bi-directional, non-interval meter without remote access – in which a distribution class meter with multiple registers is installed. One set of registers will record energy flows from the Company to the Facility during periods when the Facility is a net consumer of energy (the other register will record no flow during these periods) and a second set of registers will flow energy flows from the Facility to the Company during periods when

the Facility is a net producer of energy (the other register will record no flow during these periods). Each set of registers will record total flows only and will not record flows during specific intervals. All metering equipment included in this type of installation, including self-contained meters and instrument transformers and meters, shall meet ANSI C12.1 Metering Accuracy Standards and ANSI C57.13 accuracy requirements for instrument transformers.

- Bi-directional, interval meter with remote access – in which a distribution class meter with multiple registers is installed. One set of registers will record energy flows from the Company to the Facility during periods when the Facility is a net consumer of energy (the other register will record no flow during these periods) and a second set of registers will flow energy flows from the Facility to the Company during periods when the Facility is a net producer of energy (the other register will record no flow during these periods). Each set of registers will record total flows as well as flows during hourly intervals. In addition, the meters will be equipped with remote access capability that may include telemetering to the extent required by applicable NEPOOL standards. All metering equipment included in this type of installation shall meet the requirements contained in NEPOOL Operating Procedure No. 18, “Metering and Telemetering Criteria” and the Company’s “Policy and Practices for Metering and Telemetering Requirements for New or Modified Interconnections”. Copies of both publications are available from the Company upon request. The Interconnecting Customer shall be responsible for providing all necessary leased telephone lines and any necessary protection for leased lines and shall furthermore be responsible for all communication required by ISO-New England, or by ISO-New England’s designated satellite. The Interconnecting Customer shall maintain all telemetering and transducer equipment at the Facility in accordance with ISO-New England criteria, rules and standards. The Company will purchase, own and maintain all telemetering equipment located on the Interconnecting Customer’s facilities, if the Interconnecting Customer desires, at the Interconnecting

Customer's expense. The Interconnecting Customer shall provide, install and own Company-approved or Company-specified test switches in the transducer circuits.

**7.3.1 Category 1 and 2 Facilities:** Unless the Interconnecting Customer elects another form of metering, Category 1 and 2 Facilities will be equipped with Net Metering.

**7.3.2 Category 3 and 4 Facilities:** Category 3 and 4 Facilities shall not be entitled to utilize Net Metering. Category 3 and 4 Facilities will be equipped with a bi-directional, non-interval meter without remote access; provided, however a bi-directional, interval meter with remote access shall be installed if the Interconnecting Customers elects to install such meter at its expense or the sale of energy from the Facility requires such a meter (such as in the case of a sale from the Facility to the NEPOOL markets or to a third party).

**7.3.3 Category 5 Facilities:** Category 5 Facilities shall only be equipped with bi-directional, interval meters with remote access. In addition, Category 5 Facilities which are 5 MW or greater are required by NEPOOL Operating Procedure No. 18 to provide telemetering equipment and to supply accurate and reliable information to system operators regarding metered values for MW, MVAR, volt, amp, frequency, breaker status and all other information deemed necessary by ISO-NE and the NEPOOL Satellite (REMVEC).

**8.0 Notice Provisions:** If at any time, in the reasonable exercise of the Company's judgment, operation of the Facility adversely affects the quality of service to the Company's customers or interferes with the safe and reliable operation of the Distribution System, the Company may discontinue interconnection service to the Interconnecting Customer until the condition has been corrected. Unless an emergency exists or the risk of one is imminent, the Company shall give Interconnecting Customer reasonable notice of its intention to discontinue service and, where practical, allow suitable time for Interconnecting Customer to remedy the offending condition. The Company's judgment with regard to discontinuance of deliveries or

disconnection of facilities under this paragraph shall be made in accordance with Good Utility Practice. In the case of such discontinuance, the Company shall immediately confer with Interconnecting Customer regarding the conditions causing such discontinuance and its recommendation concerning the timely correction thereof.

**9.0 Access and Control:** Properly accredited representatives of the Company or its Affiliate shall at all reasonable times have access to the Facility to make reasonable inspections and obtain information required in connection with this Interconnection Requirements Document. At the Facility, such representatives shall make themselves known to the Interconnecting Customer's personnel, state the object of their visit, and conduct themselves in a manner that will not interfere with the construction or operation of the Facility. The Company or its Designated Agent will have control such that it may open or close the circuit breaker or disconnect and place safety grounds at the Point of Receipt, Point of Delivery, or at the station if the Point of Delivery is remote from the station.

## **10.0 Force Majeure and Indemnification**

**10.1 Force Majeure:** An event of Force Majeure means any act of God, labor disturbance, act of the public enemy, war, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment, any curtailment, order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond either party's control. A Force Majeure event does not include an act of negligence or intentional wrongdoing. Neither the Company nor the Interconnecting Customer will be considered in default as to any obligation under this Interconnection Requirements Document if prevented from fulfilling the obligation due to an event of Force Majeure. However, a party whose performance is hindered by an event of Force Majeure shall make all reasonable efforts to perform its obligations under this Interconnection Requirements Document.

**10.2 Indemnification:** The Interconnecting Customer shall at all times indemnify, defend, and save the Company harmless from any and all damages, losses, claims, including claims and actions relating to injury to or death of any person or damage to property, demands,

suits, recoveries, costs and expenses, court costs, attorney fees, and all other obligations by or to third parties, arising out of or resulting from the Company's performance of its obligations under this Interconnection Requirements Document on behalf of the Interconnecting Customer, except in cases of gross negligence or intentional wrongdoing by the Company.

**10.3 Insurance:** For Category 2 Facilities, except Category 2 Facilities that are Net Metered, and all Category 3, 4 and 5 Facilities, the Interconnecting Customer shall be required to provide and maintain insurance coverage as described in Exhibit 6, attached hereto and incorporated by reference.

Effective: February 15, 2002

**EXHIBIT 1**

**NOTICE OF INTENT TO INTERCONNECT**

The following information must be provided with the Interconnecting Customer's Notice of Intent to Interconnect:

- a) The name and address of the Interconnecting Customer and location of the generating facility;
- b) A brief description of the generating facility, including a statement indicating whether the generating facility is a small power production facility or cogeneration facility;
- c) The primary energy source used or to be used by the generating facility;
- d) The power production capacity of the generating facility and the maximum net capacity that may be delivered to the Company's system;
- e) The owners of the generating facility, including the percentage ownership by any electric utility or public utility holding company, or by any entity owned by either;
- f) The expected date of installation and the anticipated on-line date;
- g) The anticipated purchaser of the output of excess output of the generating facility (the Company or other third party) and the anticipated form (simultaneous purchase and sale, net purchase and sale, net metering, or other method);
- h) A description of any power conditioning equipment to be located between the generating facility and the Company's system;
- i) A description of the type of generator used in the generating facility installation (synchronous, induction, photovoltaic, or other).

To the extent practical, the above information may be submitted using the accompanying form.

### NOTICE OF INTENT TO INTERCONNECT

|  |                         |   |                          |  |  |
|--|-------------------------|---|--------------------------|--|--|
| APPLICANT  |                         | TELEPHONE #                                   |                          | DATE   |  |
| STREET (MAILING) ADDRESS   |                         |   | CITY, STATE & ZIP CODE   |  |  |
| FACILITY LOCATION<br>(IF NOT ADDRESS ABOVE)  |                         |   | CITY, STATE & ZIP CODE   |  |  |
| UTILITY PROVIDING SERVICE  |                         |   | ACCOUNT NUMBER           |  |  |
| ENERGY<br>SOURCE   | PEAK POWER<br>RATING-KW | INVERTER TYPE <sup>1</sup><br>(if applicable) |                          | GENERATOR TYPE <sup>2</sup><br>(if applicable) |  |
| <p>1. Only inverters meeting IEEE Standard 929-2000 and UL Standard 1741 are qualified for interconnection. The Company will determine from this application if your inverter is qualified and contact you.</p> <p>2. Any rotating generator requires protective equipment at the point of interconnection. If you have this type of generator, the Company will contact you regarding required equipment based upon this application.</p> |                         |   |                          |  |  |
| If an ownership connection exists between the applicant and this utility or National Grid USA, please provide details below and on the back of this form.  |                         |   |                          |  |  |
| ESTIMATED INSTALLATION DATE  |                         |   | ESTIMATED OPERATION DATE |  |  |
| <p>If the generating facility is rated at 60 KW or less you are eligible for monthly net energy billing.</p> <p>If eligible, do you request single-meter net energy billing/sales? YES ____ NO ____</p>  |                         |   |                          |  |  |

I hereby certify that, to the best of my knowledge, all of the information provided in this Notice is true.

Signature of Applicant \_\_\_\_\_

**EXHIBIT 2**  
**Interconnection Service Agreement**

- 1.0 This Interconnection Service Agreement, dated as of \_\_\_\_\_ is entered into, by and between either Massachusetts Electric Company or the Nantucket Electric Company, as appropriate, (hereinafter referred to as the “Company”), and \_\_\_\_\_ (“Interconnecting Customer”).
- 2.0 The Interconnecting Customer has been determined by the Company to have tendered a Notice of Intent to Interconnect, pursuant to 220 C.M.R. §8.04 to interconnect the Facility described in Attachment 1.
- 3.0 The Company agrees to provide and the Interconnecting Customer agrees to take and pay for Interconnection Service in accordance with the provisions of the Company’s Interconnection Requirements Document, as may be amended from time to time, this Interconnection Service Agreement, and any Attachments to this Interconnection Service Agreement.
- 4.0 The Interconnecting Customer agrees at all times to operate and maintain the Facility in accordance with the requirements of the Company’s Interconnection Requirements Document.
- 5.0 The Company agrees to construct the Distribution Facilities Upgrades identified in Attachment 2 that are required to accommodate the interconnection of the Facility to the Company’s Distribution System. The Interconnecting Customer agrees to pay to the Company the amounts shown in Attachment 3 for the construction of the Distribution Facilities Upgrades.
- 6.0 The Interconnecting Customer has elected to (initial one) ( ) own ( ) have the Company own the associated meter and agrees, in addition to the amounts specified in paragraph 5 above, to pay to the Company each month the applicable metering charge as set forth in the Company’s P-Rate, as approved by the Massachusetts Department of Telecommunications and Energy from time to time.
- 7.0 Any notice or request made to or by either party regarding this Interconnection Service Agreement shall be made to the representative of the other party as indicated below:

Nantucket Electric Company  
Massachusetts Electric Company  
55 Bearfoot Road  
Northborough, MA 01532  
Attn: Senior Vice President – Business Services

Interconnecting Customer:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

8.0 The Terms and Conditions for Distribution Service, where not in conflict with the terms hereof, are incorporated herein and made a part hereof.

IN WITNESS WHEREOF, the parties have caused this Interconnection Service Agreement to be executed by their respective authorized officials.

Nantucket Electric Company \_\_\_\_: or Massachusetts Electric Company \_\_\_\_:

By: \_\_\_\_\_  
Name Title Date

Interconnecting Customer:

By: \_\_\_\_\_  
Name Title Date

Attachment 1

Description of Facilities

Attachment 2

Distribution Facilities Upgrades

Attachment 3

Costs for the Construction of the Distribution Facilities Upgrades

### **EXHIBIT 3**

#### **Policy and Practices for Protection Requirements For New or Modified Generation Interconnections with the Distribution System**

Any Facility desiring to interconnect with the Company's Distribution System or modify an existing interconnection must meet the technical specifications and requirements set forth in this Protection Policy. Once interconnected, the Company, in keeping with Good Utility Practice and in its sole discretion, may disconnect from the Facility if the Facility deviates from the technical specifications and requirements contained in this Protection Policy. The Facility must return to full compliance with this Protection Policy prior to reconnecting with the Company's system.

The specifications and requirements listed herein are intended solely to mitigate possible adverse impacts caused by the Facility on the Company's equipment and on other customers of the Company. They are not intended to address protection of the Facility itself or its internal load. It is the responsibility of the Facility to comply with the requirements of all appropriate standards, codes, statutes and authorities to protect itself and its loads.

To determine the protection requirements for a given Facility, the following Categories have been established:

| Categor<br>y | Maximum Output (kW)      |
|--------------|--------------------------|
| 1            | $\leq 10$                |
| 2            | $> 10$ and $\leq 60$     |
| 3            | $> 60$ and $\leq 300$    |
| 4            | $> 300$ and $\leq 1,000$ |
| 5            | $> 1,000$                |

## **I Protection Requirements**

### **Category 1 Facilities**

#### **General Requirements:**

If, due to the interconnection of the Facility, when combined with preexisting facilities interconnected to the Company's system, the rating of any of the Company's equipment or the equipment of others connected to the Company's system will be exceeded or its control function will be adversely affected, the Company shall have the right to require the Interconnecting Customer to pay for the purchase, installation, replacement or modification of equipment to eliminate the condition. Where such action is deemed necessary by the Company, the Company will, where possible, permit the Interconnecting Customer to choose among two or more options for meeting the Company's requirements as described in this Protection Policy.

#### **Requirements for Inverter-based (Type A) installations:**

- a. The Company's distribution circuits generally operate with automatic reclosing following a trip with automatic reclosing times as short as five seconds without regard to whether the Facility is keeping the circuit energized. The Facility is responsible for protecting its equipment from being re-connected out of synchronism with the Company's system by an automatic line reclosure operation.
- b. The following information must be submitted by the Interconnecting Customer for review and acceptance by the Company prior to the Company's approving the Interconnecting Customer's request for interconnection:
  - An electrical one-line diagram or sketch depicting how the inverter will be interconnected relative to the service entrance panel and the electric meter.
  - The make, model and manufacturer's specification sheet for the inverter.
- c. For Facilities that utilize photovoltaic technology, it is required that the system be installed in compliance with IEEE Standard 929-2000, "IEEE Recommended Practice for Utility Interface of Photovoltaic (PV) Systems". The inverter shall meet the

Underwriters Laboratories Inc. Standard UL 1741, “Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems”. Based on the information supplied by the Interconnecting Customer, if the Company determines the inverter is in compliance with UL 1741, the Interconnecting Customer’s request for interconnection will be approved without the need to conduct a Distribution Facilities Impact Study or a Distribution Facilities Detailed Study.

- d. For Facilities that utilize wind technology or other direct current energy sources and employ inverters for production of alternating current, the inverter shall meet the Underwriters Laboratories Inc. Standard UL 1741, “Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems”. Based on the information supplied by the Interconnecting Customer, if the Company determines the inverter is in compliance with UL 1741 the Interconnecting Customer’s request for interconnection will be approved without the need to conduct a Distribution Facilities Impact Study or a Distribution Facilities Detailed Study.

**Requirements for Induction Generator (Type B) installations:**

- a. The following information must be submitted by the Interconnecting Customer for review and acceptance by the Company prior to the Interconnecting Customer finalizing the Facility’s protection design and the Company’s approving the Interconnecting Customer’s request for interconnection:
  - Three copies of a Facility one-line drawing.
  - Three copies of a one-line drawing showing the relays, if required herein, and metering including current transformer (“CT”) and voltage transformer (“VT”) connections and ratios.
  - Three copies of a three-line drawing for three phase units or a two-line drawing for single phase units showing the AC connections to the relays, if required herein, and meters.
  - The generator nameplate information including rated voltage, rated current, power factor, HP/kW, rated speed and locked rotor current.

- If the Facility owns the transformer between the Company and the Facility, the generator step up transformer nameplate information including rated voltage, rated kVA, proposed winding connections, positive sequence impedance plus zero sequence impedance and zero sequence equivalent circuit.
  - A list of protective relay equipment proposed to be furnished to conform to this Protection Policy including relay types, styles, manufacturer's catalog numbers, ranges and descriptive bulletins. Three copies of applicable relay instruction manuals may also be required if the Company does not already possess them.
  - Schematic drawings showing the control circuits for the interconnection breaker(s) or contactor(s).
  - Specifications for CTs and VTs relevant to the interconnection including their make, model, accuracy class, ratio, and available taps.
  - The proposed grounding method for the stator winding of the generator.
  - Other information that may be determined by the Company as required for a specific interconnection.
- b. The Interconnecting Customer must submit to the Company relay settings for all Facility protective relays that affect the interconnection with the Company's system at least four weeks prior to the scheduled date for setting the relays for review and acceptance by the Company.
- c. A Facility using induction generator(s) connected in the vicinity of capacitance sufficient to self-excite the generator(s) must meet the requirements for synchronous machines of the same Category. The capacitors that enable self-excitation may actually be external to the Facility and may belong to the Company or to other customers of the Company. The Company will not restrict the existing or future application of capacitors on its lines nor restrict their use by other customers to accommodate a Facility with induction machines.
- d. As changes occur in the location and size of capacitors, the Facility may be required in the future to upgrade its interface to meet the requirements for synchronous machines if self-excitation becomes possible even if not initially possible.
- e. A circuit breaker or contactor shall be installed to isolate the Facility from the Company's system ("Interconnection Breaker" or "Interconnection Contactor"). If there

is more than one Interconnection Breaker or Interconnection Contactor, the requirements of this Protection Policy shall apply to each one individually.

- f. The Company will review the relay settings as submitted to assure adequate protection for the Company's facilities. The Company shall not be responsible for the protection of the Facility's facilities. The Facility shall be responsible for protection of its system against possible damage resulting from parallel operation with the Company. If requested by the Interconnecting Customer, the Company will provide system protection information for the line terminal(s) directly related to the interconnection. This protection information is provided exclusively for use by the Interconnecting Customer in evaluating protection of the Facility's facilities during parallel operation.
- g. The Company reserves the right to specify the winding connections for the transformer between the Company's voltage and the Facility's voltage ("Step Up Transformer") as well as whether it is to be grounded or ungrounded at the Company's voltage. In the event that the transformer winding connection is grounded-wye/grounded-wye the Company reserves the right to specify whether the generator stator is to be grounded or not grounded. The Interconnecting Customer shall be responsible for procuring equipment with a level of insulation and fault withstand capability compatible with the specified grounding method.
- h. In general, across the line starting of rotating machines is not permitted unless it can be demonstrated that the resultant voltage flicker is within the Company's limits for starting of similar sized motors. If an Interconnection Breaker or latching type contactor is to be tripped by protective relays to satisfy this Protection Policy, then the Interconnection Breaker or Interconnection Contactor control circuits shall be DC powered from a station battery or Company-approved equivalent.
- i. A control interlock scheme that detects voltage on the Company's line(s) shall be used to prevent the Facility from energizing or attempting to energize the Company's line(s). The logic for this scheme should be hardwired to prevent the Interconnection Breaker (or Interconnection Contactor where appropriate) from closing. No interposing computer or programmable logic controller or the like shall be used in this logic.
- j. The Facility shall provide a disconnect switch at the interconnection point with the

Company that is accessible to Company personnel at all times that can be opened for isolation. The Company shall have the right to open this disconnect switch during emergency conditions or with reasonable notice to the Interconnecting Customer at other times. The Company shall exercise such right in accordance with Good Utility Practice. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum generator output and be capable of being locked open, tagged and grounded on the Company side by Company personnel. The switch shall be of a manufacture and type generally accepted for use by the Company.

- k. Where protective relays are required by this Protection Policy, their control circuits shall be DC powered from a station battery. Solid-state relays shall be self-powered or DC powered from a station battery. If the Facility uses a non-latching interconnection contactor, AC powered relaying satisfying the requirements of this Protection Policy may be allowed provided the relay and its method of application is fail safe, meaning that if the relay fails or if the voltage and/or frequency of its AC power source deviate from the relay's design requirements for power, the relay will immediately trip the generator by opening the coil circuit of the Interconnection Contactor.
- l. CT ratios and accuracy classes shall be chosen such that secondary current is less than 100 amperes and transformation errors are less than 10% under maximum fault conditions.
- m. If the interconnection voltage requires, a voltage transformer shall be provided by the Facility and shall be connected to the Company side of the Interconnecting Breaker or Interconnecting Contactor. The voltage from this VT shall be used in the interlock as specified above. For three phase applications, a VT for each phase is required.
- n. All protective relays required by this Protection Policy shall meet ANSI/IEEE Standard C37.90, C37.90.1 and C37.90.2 and be of a manufacturer and type generally accepted for use by the Company.
- o. Voltage relays shall be frequency compensated to provide a uniform response in the range of 40 to 70Hz.
- p. Tripping by protective relays required to satisfy this Protection Policy must be hardwired to the device they are tripping. No interposing computer or programmable logic

controller or the like is permitted in the trip chain between the relay and the device being tripped.

- p. On three phase installations where voltage relaying is required by this Protection Policy, all three phases must be sensed either by three individual relays or by one relay that contains three elements. If the voltage on any of the three phases is outside the bounds specified by the Company, the unit shall be tripped.
- q. The Facility shall provide an undervoltage relay sensing voltage, preferably on the Company's side of the Interconnection Breaker or Interconnection Contactor, which trips the Interconnection Breaker or Interconnection Contactor; provided, however, for single phase units, an undervoltage relay is not required, provided the generator is interconnected through a non-latching contactor whose coil is held by AC voltage from the Company's side of the contactor such that the contactor drops out and will not close in the absence of Company voltage.

**Requirements for Synchronous Generator (Type C) installations:**

Category 1 Facilities utilizing synchronous generators shall meet all the requirements that are applicable to synchronous generators for Category 2, 3, 4 and 5 Facilities.

**Category 2 Facilities**

**General Requirements:** The Facility shall provide a disconnect switch at the interconnection point with the Company that can be opened for isolation. The switch shall be in a location accessible to Company personnel at all times. The Company shall have the right to open this disconnect switch during emergency conditions and with reasonable notice to the Interconnecting Customer at other times. The Company shall exercise such right in accordance with Good Utility Practice. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum generator output and be capable of being locked open, tagged and grounded on the Company side by Company personnel. The switch shall be of a type generally accepted for use by the Company.

**Requirements for Inverter-based (Type A) installations:**

- a. The Company's distribution circuits generally operate with automatic reclosing following a trip with automatic reclosing times as short as five seconds without regard to whether the Facility is keeping the circuit energized. The Facility is responsible for protecting its equipment from being re-connected out of synchronism with the Company's system by an automatic line reclosure operation.
- b. b. The following information must be submitted by the Interconnecting Customer for review and acceptance by the Company prior to the Company's approving the Interconnecting Customer's request for interconnection:
  - X An electrical one line diagram or sketch depicting how the inverter will be interconnected relative to the service entrance panel and the electric meter.
  - X The make, model and manufacturer's specification sheet for the inverter.
- c. For Facilities that utilize photovoltaic technology, it is required that the system be installed in compliance with IEEE Standard 929-2000, "IEEE Recommended Practice for Utility Interface of Photovoltaic (PV) Systems". It is required that the inverter meet the Underwriters Laboratories Inc. Standard UL 1741, "Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems".
- d. For Facilities that utilize wind technology, fuel cell technology or other inverter-based systems, the inverter must meet the Underwriters Laboratories Inc. Standard UL 1741, "Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems".

**Requirements for Induction Generator (Type B) installations:**

- a. The following information must be submitted by the Interconnecting Customer for review and acceptance by the Company prior to the Interconnecting Customer finalizing the Facility's protection design and the Company's approving the Interconnecting Customer's request for interconnection:
  - Three copies of a Facility one-line drawing.

- Three copies of a one-line drawing showing the relays, if required herein, and metering including current transformer (“CT”) and voltage transformer (“VT”) connections and ratios.
  - Three copies of a three-line drawing for three phase units or a two-line drawing for single phase units showing the AC connections to the relays, if required herein, and meters.
  - The generator nameplate information including rated voltage, rated current, power factor, HP/kW, rated speed and locked rotor current.
  - If the Facility owns the transformer between the Company and the Facility, the generator step up transformer nameplate information including rated voltage, rated kVA, proposed winding connections, positive sequence impedance plus zero sequence impedance and zero sequence equivalent circuit.
  - A list of protective relay equipment proposed to be furnished to conform to this Protection Policy including relay types, styles, manufacturer’s catalog numbers, ranges and descriptive bulletins. Three copies of applicable relay instruction manuals may also be required if the Company does not already possess them.
  - Schematic drawings showing the control circuits for the interconnection breaker(s) or contactor(s).
  - Specifications for CTs and VTs relevant to the interconnection including their make, model, accuracy class, ratio, and available taps.
  - The proposed grounding method for the stator winding of the generator.
  - Other information that may be determined by the Company as required for a specific interconnection.
- b. Relay settings for all Facility protective relays that affect the interconnection with the Company’s system must be submitted at least four weeks prior to the scheduled date for setting the relays for review and acceptance by the Company.
- c. A Facility using induction generator(s) connected in the vicinity of capacitance sufficient to self-excite the generator(s) must meet the requirements for synchronous machines of the same Category. The capacitors that enable self-excitation may actually be external to the Facility and may belong to the Company or to other customers of the Company. The

Company will not restrict the existing or future application of capacitors on its lines nor restrict their use by other customers to accommodate a Facility with induction machines.

- d. As changes occur in the location and size of capacitors, the Facility may be required in the future to upgrade its interface to meet the requirements for synchronous machines if self-excitation becomes possible even if not initially possible.
- e. A circuit breaker or contactor shall be installed to isolate the Facility from the Company's system ("Interconnection Breaker" or "Interconnection Contactor"). If there is more than one Interconnection Breaker or Interconnection Contactor, the requirements of this Protection Policy shall apply to each one individually.
- f. The Company will review the relay settings as submitted by the Interconnecting Customer to assure adequate protection for the Company's facilities. The Company shall not be responsible for the protection of the Facility's facilities. The Facility shall be responsible for protection of its system against possible damage resulting from parallel operation with the Company. If requested by the Interconnecting Customer, the Company will provide system protection information for the line terminal(s) directly related to the interconnection. This protection information is provided exclusively for use by the Interconnecting Customer in evaluating protection of the Facility's facilities during parallel operation.
- g. The Company reserves the right to specify the winding connections for the transformer between the Company's voltage and the Facility's voltage ("Step Up Transformer") as well as whether it is to be grounded or ungrounded at the Company's voltage. In the event that the transformer winding connection is grounded-wye/grounded-wye the Company reserves the right to specify whether the generator stator is to be grounded or not grounded. The Interconnecting Customer shall be responsible for procuring equipment with a level of insulation and fault withstand capability compatible with the specified grounding method.
- h. In general, across the line starting of rotating machines is not permitted unless it can be demonstrated that the resultant voltage flicker is within the Company's limits for starting of similar sized motors. If an Interconnection Breaker or latching type contactor is to be tripped by protective relays to satisfy the requirements of this Protection Policy, then the

Interconnection Breaker or Interconnection Contactor control circuits shall be DC powered from a station battery or Company-approved equivalent.

- i. A control interlock scheme that detects voltage on the Company's line(s) shall be used to prevent the Facility from energizing or attempting to energize the Company's line(s). The logic for this scheme should be hardwired to prevent the Interconnection Breaker (or Interconnection Contactor where appropriate) from closing. No interposing computer or programmable logic controller or the like shall be used in this logic.
- j. The Facility shall provide a disconnect switch at the interconnection point with the Company that is accessible to Company personnel at all times that can be opened for isolation. The Company shall have the right to open this disconnect switch during emergency conditions and with reasonable notice to the Interconnecting Customer at other times. The Company shall exercise such right in accordance with Good Utility Practice. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum generator output and be capable of being locked open, tagged and grounded on the Company side by Company personnel. The switch shall be of a manufacture and type generally accepted for use by the Company.
- k. Where protective relays are required by this Protection Policy, their control circuits shall be DC powered from a station battery. Solid-state relays shall be self-powered or DC powered from a station battery. If the Facility uses a non-latching interconnection contactor, AC powered relaying satisfying the requirements of this Protection Policy may be allowed provided the relay and its method of application is fail safe, meaning that if the relay fails or if the voltage and/or frequency of its AC power source deviate from the relay's design requirements for power, the relay will immediately trip the generator by opening the coil circuit of the Interconnection Contactor.
- l. CT ratios and accuracy classes shall be chosen such that secondary current is less than 100 amperes and transformation errors are less than 10% under maximum fault conditions.
- m. If the interconnection voltage requires, a voltage transformer shall be provided by the Facility and shall be connected to the Company side of the interconnecting breaker or

contactor. The voltage from this VT shall be used in the interlock as specified above.

For three phase applications, a VT for each phase is required.

- n. All protective relays required by this Protection Policy shall meet ANSI/IEEE Standard C37.90, C37.90.1 and C37.90.2 and be of a manufacturer and type generally accepted for use by the Company.
- o. Voltage relays shall be frequency compensated to provide a uniform response in the range of 40 to 70Hz.
- p. Tripping by protective relays required to satisfy the requirements of this Protection Policy must be hardwired to the device they are tripping. No interposing computer or programmable logic controller or the like is permitted in the trip chain between the relay and the device being tripped.
- q. On three phase installations where voltage relaying is required by this Protection Policy, all three phases must be sensed either by three individual relays or by one relay that contains three elements. If the voltage on any of the three phases is outside the bounds specified by the Company, the unit shall be tripped.
- r. The Facility shall provide an undervoltage relay sensing voltage, preferably on the Company's side of the interconnection breaker or contactor, which trips the interconnection breaker or contactor.

#### **Requirements for Synchronous Generator (Type C) installations:**

Category 2 Facilities utilizing synchronous generators shall meet all the requirements that are applicable to synchronous generators for Category 3, 4 and 5 Facilities.

### **CATEGORY 3, 4 and 5 Facilities**

#### **Protection related information**

- a. The following information must be submitted by the Interconnecting Customer for review and acceptance by the Company prior to the Interconnecting Customer finalizing the Facility's protection design and the Company's approving the Interconnecting Customer's request for interconnection:

- II Three copies of a station one-line drawing.
- II Three copies of a one-line drawing showing the relays and metering including current transformer (CT) and voltage transformer (VT) connections and ratios.
- II Three copies of a three-line drawing showing the AC connections to the relays and meters.
- II If the Facility is a synchronous generator, the nameplate information including rated voltage, rated current, rated kVA and power factor plus transient, sub-transient and synchronous impedances and zero sequence impedance.
- II If the Facility is an induction generator, the nameplate information including rated voltage, rated current, power factor, HP/kW, rated speed, locked rotor current, stator reactance, stator resistance, rotor reactance, rotor resistance and magnetizing reactance.
- II If the Facility owns the transformer between the Company and the Facility, the nameplate information including rated voltage, rated kVA, proposed winding connections, positive sequence impedance plus zero sequence impedance and zero sequence equivalent circuit.
  - A list of protective relay equipment proposed to be furnished to conform to this Protection Policy including relay types, styles, manufacturer's catalog numbers, ranges and descriptive bulletins. Three copies of applicable relay instruction manuals may also be required if the Company does not already possess them.
- II Schematic drawings showing the control circuits for the interconnection breaker(s) and synchronizing breaker(s).
- II Specifications for CTs and VTs relevant to the interconnection including their make, model, accuracy class, ratio, and available taps.
- II Interconnection breaker operating time if it is tripped by protective relays required by this Protection Policy.
- II The proposed grounding method for the stator winding.
- II Other information that may be determined by the Company as required for a specific interconnection.

- b. Relay settings for all Facility protective relays that affect the interconnection with the Company's system must be submitted at least four weeks prior to the scheduled date for setting the relays for review and acceptance by the Company.
- c. If, due to the interconnection of the Facility to the line, the fault interrupting, continuous, momentary or other rating of any of the Company's equipment or the equipment of other customers connected to the Company's system is exceeded, the Company shall have the right to require the Interconnecting Customer to pay for the purchase, installation, replacement or modification of equipment to eliminate the condition. Likewise, when the proposed interconnection may result in reversed load flow through the Company's load tap changing transformer(s), line voltage regulator(s) or secondary network protector(s), control modifications necessary to mitigate the effects may be made to these devices by the Company at the Interconnecting Customer's expense or the Facility may be required to limit its output so reverse load flow cannot occur or to provide reverse power relaying that trips the Facility. Where such action is deemed necessary by the Company, the Company will, where possible, permit the Interconnecting Customer to choose among two or more options for meeting the Company's requirements as described in this Protection Policy.

### **Protection requirements**

- a. A circuit breaker shall be installed to isolate the Facility from the Company's system ("Interconnection Breaker"). If there is more than one Interconnection Breaker, the requirements of this Protection Policy apply to each one individually.
- b. The Interconnecting Customer shall designate one or more breakers to be used to synchronize the Facility's generator to the Company's system. This "synchronizing breaker" could be a breaker other than the Interconnection Breaker. In some induction generator applications a contactor may serve this function.
- c. The Company's lines generally have automatic reclosing following a trip with reclosing times as short as five seconds without regard to whether the Facility is keeping the circuit energized. The Interconnecting Customer is responsible for protecting the Facility's equipment from being re-connected out of synchronism with the Company's system by an

automatic line reclosure operation. The Interconnecting Customer may choose to install additional equipment such as direct transfer tripping from the Company's station(s) to insure the Facility is off the line prior to the line reclosing. However this option is not feasible in all cases, particularly where the Company uses pole-mounted reclosers between its substation and the Facility.

- d. The Company will review the relay settings as submitted by the Interconnecting Customer to assure adequate protection for the Company's facilities. The Company shall not be responsible for the protection of the Facility's facilities. The Interconnecting Customer shall be responsible for protection of the Facility's system against possible damage resulting from parallel operation with the Company. If requested by the Interconnecting Customer, the Company will provide system protection information for the line terminal(s) directly related to the interconnection. This protection information is provided exclusively for use by the Interconnecting Customer in evaluating protection of the Facility's facilities during parallel operation.
- e. The Company reserves the right to specify the winding connections for the transformer between the Company's voltage and the Facility's voltage ("Step Up Transformer") as well as whether it is to be grounded or ungrounded at the Company's voltage. In the event that the transformer winding connection is grounded-wye/grounded-wye the Company also reserves the right to specify if and how the generator stator is to be grounded. The Facility will be responsible for procuring its equipment with a level of insulation and fault withstand capability compatible with the specified grounding method.
- f. Across the line starting of rotating machines is not permitted unless it can be demonstrated that the resultant voltage flicker is within the Company's limits for starting of similar sized motors.

#### **Protection equipment requirements**

- a. Where the Interconnection Breaker (or Interconnection Contactor as may be the case with some smaller induction machines) is to be tripped by protective relays required to meet

the requirements of this Protection Policy then the Interconnection Breaker (or Interconnection Contactor) control circuits shall be DC powered from a station battery.

- b.** The synchronizing breaker(s) must be capable of withstanding at least twice rated system voltage and must be capable of interrupting the current produced when the Facility is connected out of phase with the Company's system.
- c.** A control interlock scheme that detects voltage on the Company's line(s) shall be used to prevent the Facility from energizing or attempting to energize the Company's line(s). The logic for this scheme should be hardwired to prevent the synchronizing breaker, Interconnection Breaker (or Interconnection Contactor where appropriate) from closing. No interposing computer or programmable logic controller or the like is to be used in this logic.
- d.** The Facility shall be equipped with a switch at the interconnection point with the Company that can be opened for isolation. The Company shall have the right to open the interconnection during emergency conditions and with reasonable notice to the Interconnecting Customer at other times. The Company shall exercise such right in accordance with Good Utility Practice. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum generator output and be capable of being locked open, tagged and grounded on the Company side by Company personnel. The switch shall be of a manufacture and type generally accepted for use by the Company.
- e.** Protective relaying control circuits shall be DC powered from a station battery. Solid-state relays shall be self-powered or DC powered from a station battery.
- f.** CT ratios and accuracy classes shall be chosen such that secondary current is less than 100 amperes and transformation errors are less than 10% under maximum fault conditions.
- g.** The Facility shall be equipped with a voltage transformer, connected to the Company side of the interconnecting breaker. The voltage from this VT shall be used in the interlock as specified in this Protection Policy. If the Facility's step up transformer is ungrounded at the Company voltage, this VT shall be a single three-phase device or three single-phase devices connected from each phase to ground on the Company's side of the

Facility's step up transformer, rated for phase-to-phase voltage and provided with two secondary windings. One winding shall be connected in open delta, have a loading resistor to prevent ferroresonance, and be used for the relay specified in this Protection Policy.

- h. All protective relays required by this Protection Policy shall meet ANSI/IEEE Standard C37.90, C37.90.1 and C37.90.2 and be of a manufacture and type generally accepted for use by the Company.
- i. Voltage relays shall be frequency compensated to provide a uniform response in the range of 40 to 70Hz.
- j. Protective relays utilized by the Facility as required per this Protection Policy shall be sufficiently redundant and functionally separate so as to provide adequate protection, as determined by the Company, upon the failure of any one component. The use of a single all-inclusive relay package is not acceptable.
- k. The Company may require the Facility to be equipped with two independent, redundant relaying systems in accordance with NPCC criteria for the protection of the bulk power system if the interconnection is to the bulk power system or if it is determined that delayed clearing of faults within the Facility adversely affects the bulk power system.
- l. A direct transfer tripping system, if one is required by either the Interconnecting Customer or by the Company, shall use equipment generally accepted for use by the Company and shall, at the option of the Company, use dual channels.
- m. Tripping by protective relays required to satisfy the requirements of this Protection Policy must be hardwired to the device they are tripping. No interposing computer or programmable logic controller or the like is permitted in the trip chain between the relay and the device being tripped.
- n. On three phase installations when voltage relaying is required by this Protection Policy, all three phases must be sensed either by three individual relays or by one relay that contains three elements. If the voltage on any of the three phases is outside the bounds specified by the Company the unit shall be tripped.

**Requirements for Induction Generator (Type B) installations**

- a. A Facility using induction generators connected in the vicinity of capacitance sufficient to self-excite the generator(s) shall meet the requirements for synchronous machines in this Protection Policy. The capacitors that enable self-excitation may actually be external to the Facility. The Company will not restrict its existing or future application of capacitors on its lines nor restrict their use by other customers of the Company to accommodate a Facility with induction machines. As changes occur in the location and size of capacitors, the Facility may be required in the future to upgrade its interface to meet the requirements for synchronous machines if self-excitation becomes possible, even if not initially possible.

The Facility may be required to install capacitors to limit the adverse effects of drawing reactive power from the system for excitation of the generator. Capacitors for supply of reactive power at or near the induction generator with a kVAR rating greater than 30% of the generator's kW rating may cause the generator to become self-excited. (If self-excitation can occur, the Facility shall be required to provide protection as specified in this Protection Policy for synchronous machines.)

- b. The Facility shall be equipped with the following relays for island detection supplied from a voltage transformer that may be connected to either the generator or Company voltage:

|                  | <u>minimum setting range</u> | <u>minimum time delay range</u> |
|------------------|------------------------------|---------------------------------|
| X overfrequency  | 60 - 62Hz                    | .1 - 2 secs                     |
| X underfrequency | 60 - 58Hz                    | .1 - 2 secs                     |
| X overvoltage    | 105 - 115% normal            | .1 - 4 secs                     |
| X undervoltage   | 85 - 95% normal              | .1 - 4 secs                     |

- c. During system conditions where local area load exceeds system generation, NPCC Emergency Operation Criteria requires a program of phased automatic underfrequency

load shedding of up to 25% of area load to assist in arresting frequency decay and to minimize the possibility of system collapse. Depending on the point of connection of the Facility to the Company's system and in conformance with the NPCC Emergency Operating Criteria, the Facility may be required to remain connected to the system during the frequency decline to allow the objectives of the automatic load shedding program to be achieved, or to otherwise provide compensatory load reduction, equivalent to the Facility's generation lost to the system, if the Interconnecting Customer elects to disconnect the Facility at a higher underfrequency set point.

#### **Requirements for Synchronous Generator (Type C) installations**

- a. A synchronous generator is a source of current for faults occurring on the Company's line(s). The Facility must be equipped with protective relays to detect any faults, whether phase-to-phase or phase-to-ground, on the Company's line(s) or within the Facility, and isolate the Facility from the Company's line(s) such that the following criteria are met, as determined by the Company:
  - X The existing sensitivity of fault detection is not substantially degraded.
  - X The existing speed of fault clearing is not substantially degraded.
  - X The coordination margin between relays is not substantially reduced.
  - X The sustained unfaulted phase voltage during a line-to-ground fault is not increased beyond the design value for the existing system insulation levels and overvoltage protection.
  - X Non-directional line relays will not operate for faults external to the line due to the Facility's contribution.
  - X Proper settings for existing relays are achievable within their ranges.

The Company may perform engineering studies to evaluate the Facility's protection compliance with respect to the above and may make recommendations to the Interconnecting Customer on methods to achieve compliance. If, due to the interconnection of the Facility to the Company's system, any of the above criteria is

violated for the Company's facilities or for the facilities of others connected to the Company's system, the Company shall have the right to require the Interconnecting Customer to pay for the purchase, installation, replacement or modification of protective equipment to eliminate the violation and restore the level of protection existing prior to the interconnection. This may include the addition of pilot relaying systems involving communications between all terminals. Where such action is deemed necessary by the Company, the Company will, where possible, permit the Interconnecting Customer to choose among two or more options for meeting the Company's requirements as described in this Protection Policy.

- b. The Interconnecting Customer is responsible for procuring any communications channels necessary between the Facility and the Company's stations and for providing protection from transients and overvoltages at all ends of these communication channels. The Interconnecting Customer will also bear the ongoing cost to lease these communication channels.
- c. If the Facility's step up transformer connection is ungrounded, the Facility shall be equipped with a zero sequence overvoltage relay fed from the open delta of the three phase VT specified in this Protection Policy.
- d. The Facility shall be equipped to provide protection to limit sustained abnormal frequency and/or voltage conditions to the Company's customers directly supplied from the interconnection circuit should the Facility and its interconnection circuit become isolated from the Company's system. The protection can consist of either the following relays supplied from a voltage transformer connected to either the generator or the Company's voltage or other means if the Facility can demonstrate sufficient control of abnormal frequency and voltage excursions as seen by the Company's customers:

|                  | <u>minimum setting range</u> | <u>minimum time delay range</u> |
|------------------|------------------------------|---------------------------------|
| X overfrequency  | 60 - 62Hz                    | .1 - 2 secs                     |
| X underfrequency | 60 - 56Hz                    | .5 - 30 secs                    |
| X overvoltage    | 105 - 115% normal            | .1 - 4 secs                     |
| X undervoltage   | 85 - 95% normal              | .1 - 4 secs                     |

- e. During system conditions where local area load exceeds system generation, NPCC Emergency Operation Criteria requires a program of phased automatic underfrequency load shedding of up to 25% of area load to assist in arresting frequency decay and to minimize the possibility of system collapse. Depending on the point of connection of the Facility to the Company's system and in conformance with the Emergency Operating Criteria, the Facility may be required to remain connected to the system during the frequency decline to allow the objectives of the automatic load shedding program to be achieved, or to otherwise provide compensatory load reduction, equivalent to the Facility's generation lost to the system, if the Interconnecting Customer elects to disconnect the Facility at a higher underfrequency set point.
- e. The Facility may be required to use high-speed protection if time-delayed protection would result in degradation in the existing sensitivity or speed of the protection systems on the Company's lines.
- g. The Facility may be required to be equipped to provide local breaker failure protection which may include direct transfer tripping to the Company's line terminal(s) in order to detect and clear faults within the Facility that cannot be detected by the Company's back-up protection.
- h. The Facility shall be equipped to provide protective relaying to prevent the closing of the synchronizing breaker(s) while the Facility's generation is out-of-synchronization with the Company's system.

## **II Protection System Testing and Maintenance**

The Company shall have the right to witness the testing of selected protective relays and control circuits at the completion of construction and to receive a copy of all test data.

The Interconnecting Customer shall provide the Company with at least a one week notice prior to the final scheduling of these tests. Testing shall consist of:

- X CT and CT circuit polarity, ratio, insulation, excitation, continuity and burden tests.

- X VT and VT circuit polarity, ratio, insulation and continuity tests.
- X Relay pick-up and time delay tests.
- X Functional breaker trip tests from protective relays.
- X Relay in-service test to check for proper phase rotation and magnitudes of applied currents and voltages.
- X Breaker closing interlock tests.
- X Paralleling and de-paralleling operation.
- X Other relay commissioning tests typically performed for the relay types involved.
- X An inverter with field adjustable settings for its internal protective elements shall be tested to verify these settings if those internal elements are being used by the Facility to satisfy the requirements of this Protection Policy . The Facility shall be equipped with whatever equipment is required to perform this test. If a Asimulated utility≡ is required to perform such testing the Company is unable to provide the equipment required to perform the test.

The protective relays shall be tested and maintained by the Interconnecting Customer on a periodic basis but not less than once every four years or as otherwise determined by the Company. For relays installed in accordance with the NPCC Criteria for the Protection of the Bulk Power System, maintenance intervals shall be in accordance with such criteria. The results of these tests shall be summarized by the Interconnecting Customer and reported in writing to the Company.

Inverters with field adjustable settings for their internal protective elements shall be periodically tested if those internal elements are being used by the Facility to satisfy the requirements of this Protection Policy. If a Asimulated utility≡ is required to perform such testing the Company is unable to provide the equipment required to perform the test.

In its sole discretion, the Company may waive all or some of these requirements.

### **III. Protection Requirements – Momentary Paralleling of Standby Generators**

Protective relays to isolate the Facility for faults in the Company's system are not required if the paralleling operation is automatic and takes place for less than one-half of a second.

Parallel operation of the Facility with the Company's system shall be prevented when the Company's line is dead or out of phase with the Facility.

The control scheme for automatic paralleling must be submitted by the Interconnecting Customer for review and acceptance by the Company prior to the Facility being allowed to interconnect with the Company's system.

### **IV. Protection System Changes**

The Interconnecting Customer must provide the Company with reasonable advance notice of any proposed changes to be made to the protective relay system, relay settings, operating procedures or equipment that affect the interconnection. The Company will determine if such proposed changes require re-acceptance of the interconnection per the requirements of this Protection Policy.

In the future, should the Company implement changes to the system to which the Facility is interconnected, the Interconnecting Customer will be responsible at its own expense for identifying and incorporating any necessary changes to its protection system. These changes to the Facility's protection system are subject to review and approval by the Company.

In its sole discretion, the Company may waive all or some of these requirements.

## **EXHIBIT 4**

### **Form of Distribution Facilities Impact Study Agreement**

This Agreement dated \_\_\_\_\_, is entered into by  
(the Interconnecting Customer) and the Company, for the purpose of setting forth the terms,  
conditions and costs for conducting a Distribution Facilities Impact Study relative to  
\_\_\_\_\_.

1. The Interconnecting Customer agrees to provide, in a timely and complete manner, all required information and technical data necessary for the Company to conduct the Distribution Facilities Impact Study. The Interconnecting Customer understands that it must provide all such information and data prior to the Company's commencement of the Distribution Facilities Impact Study. Such information and technical data is specified in Attachment 1 to this Agreement.
2. All work pertaining to the Distribution Facilities Impact Study that is the subject of this Agreement will be approved and coordinated only through designated and authorized representatives of the Company and the Interconnecting Customer. Each party shall inform the other in writing of its designated and authorized representative.
3. The Company will advise the Interconnecting Customer of any additional studies as it may in its sole discretion deem necessary, in accordance with Good Utility Practice. The Company will not proceed with additional studies without the Interconnecting Customer's consent.
4. The Company contemplates that it will require [specify time] to complete the Distribution Facilities Impact Study. Upon completion of the Distribution Facilities Impact Study by the Company, the Company will provide a Distribution Facilities Impact Study Report to the Interconnecting Customer based on the information provided and developed as a

result of this effort. If, upon review of the Distribution Facilities Impact Study Report, the Interconnecting Customer decides to pursue its interconnection request, the Company will, at the Interconnecting Customer's direction, tender a Distribution Facilities Detailed Study Agreement within thirty (30) days if deemed additionally necessary by the Company. The Distribution Facilities Impact Study and Distribution Facilities Detailed Study, together with any additional studies contemplated in Paragraph 3, shall form the basis for the Interconnecting Customer's proposed use of the Company's Distribution System and shall be furthermore utilized in obtaining necessary third-party approvals of any required facilities and requested distribution services. The Interconnecting Customer understands and acknowledges that any use of study results by the Interconnecting Customer or its agents, whether in preliminary or final form, prior to NEPOOL 18.4 approval, should such approval be required, is completely at the Interconnecting Customer's risk and that the Company will not guarantee or warrant the completeness, validity or utility of study results prior to NEPOOL 18.4 approval.

5. The estimated costs contained within this Agreement are the Company's good faith estimate of its costs to perform the Distribution Facilities Impact Study contemplated by this Agreement. The Company's estimates do not include any estimates for wheeling charges that may be associated with the transmission of Facility output to third parties or with rates for station service. The actual costs charged to the Interconnecting Customer by the Company may change as set forth in this Agreement. Prepayment will be required for all study, analysis, and review work performed by the Company or its Affiliate, all of which will be billed by the Company to the Interconnecting Customer in accordance with Paragraph 6 of this Agreement.
6. The payment required is \$\_\_\_\_\_ from the Interconnecting Customer to the Company for the primary system analysis, coordination, and monitoring of the Distribution Facilities Impact Study. Such amount shall be payable in full to the Company prior to the Company beginning the work. The Company will, in writing, advise the Interconnecting Customer in advance of any cost increases for work to be performed if the total amount

increases by 10% or more. Any such changes to the Company's costs for the study work shall be subject to the Interconnecting Customer's consent. The Interconnecting Customer shall, within thirty (30) days of the Company's notice of increase, either authorize such increases and make payment in the amount set forth in such notice, or the Company will suspend the Distribution Facilities Impact Study and this Agreement will terminate. Upon suspension of the Distribution Facilities Impact Study, the parties may petition the Massachusetts Department of Telecommunications and Energy, to review the cost increase, pursuant to 220 CMR 8.04(3).

In the event this Agreement is terminated for any reason, the Company shall refund to the Interconnecting Customer the portion of the above credit or any subsequent payment to the Company by the Interconnecting Customer that the Company did not expend or commit in performing its obligations under this Agreement. Any additional billings under this Agreement shall be subject to an interest charge computed in accordance with the provisions of the Interconnection Requirements Document. Payments for work performed shall not be subject to refunding except in accordance with Paragraph 7 below.

7. If the actual costs for the work exceed prepaid estimated costs, the Interconnecting Customer shall make payment to the Company for such actual costs within thirty (30) days of the date of the Company's invoice for such costs. If the actual costs for the work are less than those prepaid, the Company will credit such difference toward the Company costs unbilled, or in the event there will be no additional billed expenses, the amount of the overpayment will be returned to the Interconnecting Customer with interest computed as stated in Paragraph 6 of this Agreement, from the date of reconciliation.
8. Nothing in this Agreement shall be interpreted to give the Interconnecting Customer immediate rights to wheel over or interconnect with the Company's Distribution System.
9. Within one (1) year following the Company's issuance of a final bill under this Agreement, the Interconnecting Customer shall have the right to audit the Company's

accounts and records at the offices where such accounts and records are maintained, during normal business hours; provided that appropriate notice shall have been given prior to any audit and provided that the audit shall be limited to those portions of such accounts and records that relate to service under this Agreement. The Company reserves the right to assess a reasonable fee to compensate for the use of its personnel time in assisting any inspection or audit of its books, records or accounts by the Interconnecting Customer or its Designated Agent.

10. The Interconnecting Customer agrees to indemnify and hold the Company and its affiliated companies and directors, officers, employees, and agents of each of them (collectively "Affiliates") harmless from and against any and all damages, costs (including attorney's fees), fines, penalties and liabilities, in tort, contract, or otherwise (collectively "Liabilities") resulting from claims of third parties arising, or claimed to have arisen as a result of any acts or omissions by the Company or its Affiliates under this Agreement. The Interconnecting Customer hereby waives recourse against the Company and its Affiliates for, and releases the Company and its Affiliates from, any and all Liabilities for or arising from damage to its property due to a performance under this Agreement by the Company or its Affiliates.
11. If either party materially breaches any of its covenants hereunder, the other party may terminate this Agreement by serving notice of same on the other party to this Agreement.
12. This agreement shall be construed and governed in accordance with the laws of the Commonwealth of Massachusetts and with 220 C.M.R. 28.00 et seq.
13. All amendments to this Agreement shall be in written form executed by both parties.
14. The terms and conditions of this Agreement shall be binding on the successors and assigns of either party.

15. This Agreement will remain in effect for a period of up to two years from its effective date as permitted by the Massachusetts Department of Telecommunications and Energy, and is subject to extension by mutual agreement. Either party may terminate this Agreement by thirty (30) days' notice except as is otherwise provided herein.

Interconnecting Customer:

The Company:

Name: \_\_\_\_\_

Name:

Title: \_\_\_\_\_

Title:

Date: \_\_\_\_\_

Date:

## **Attachment 1**

### **Information to be Provided to the Company by the Interconnecting Customer for the Distribution Facilities Impact Study**

*Note: For Category 1, 2 or 3 Facilities, the Company will accept the material requested in Exhibit 3 in lieu of the information requested in this attachment.*

#### **1.0 Facilities Identification**

- 1.1 Requested capability in MW and MVA; summer and winter
- 1.2 Site location and plot plan with clear geographical reference
- 1.3 Preliminary one-line diagram showing major equipment and extent of Interconnecting Customer
- 1.4 Auxiliary power system requirements
- 1.5 Back-up facilities such as standby generation or alternate supply sources

#### **2.0 Major Equipment**

- 2.1 Power transformer(s): rated voltage, MVA and BIL of each winding, LTC and or NLTC taps and range,  $Z_1$  (positive sequence) and  $Z_0$  (zero sequence) impedances, and winding connections. Provide normal, long-time emergency and short-time emergency thermal ratings.
- 2.2 Generator(s): rated MVA, speed and maximum and minimum MW output, reactive capability curves, open circuit saturation curve, power factor (V) curve, response (ramp) rates, H (inertia), D (speed damping), short circuit ratio,  $X_1$  (leakage),  $X_2$  (negative sequence), and  $X_0$  (zero sequence) reactances and other data:

|  | Direct<br>Axis | Quadrature<br>Axis            |
|--|----------------|-------------------------------|
| saturated synchronous reactance            | $X_{dv}$       | $X_{qv}$                      |
| unsaturated synchronous reactance          | $X_{di}$       | $X_{qi}$                      |
| saturated transient reactance              | $X_{=dv}$      | $X_{=qv}$                     |
| unsaturated transient reactance            | $X_{=di}$      | $X_{=qi}$                     |
| saturated subtransient reactance           |                | $X_{\cong dv}$ $X_{\cong qv}$ |
| unsaturated subtransient reactance         | $X_{\cong di}$ | $X_{\cong qi}$                |
| transient open-circuit time constraint     | $T_{=do}$      | $T_{=qo}$                     |
| transient short-circuit time constraint    | $T_{=d}$       | $T_{=q}$                      |
| subtransient open-circuit time constraint  | $T_{\cong do}$ | $T_{\cong qo}$                |
| subtransient short-circuit time constraint | $T_{\cong d}$  | $T_{\cong q}$                 |

- 2.3 Excitation system, power system stabilizer and governor: manufacturer's data in sufficient detail to allow modeling in transient stability simulations.
- 2.4 Prime mover: manufacturer's data in sufficient detail to allow modeling in transient stability simulations, if determined necessary.
- 2.5 Busses: rated voltage and ampacity (normal, long-time emergency and short-time emergency thermal ratings), conductor type and configuration.
- 2.6 Transmission lines: overhead line or underground cable rated voltage and impeached (normal, long-time emergency and short-time emergency thermal rates),  $Z_1$  (positive sequence) and  $Z_0$  (zero sequence) impedances, conductor type, configuration, length and termination points.
- 2.7 Motors greater than 150 kWh 3-phase or 50 kW single-phase: type (induction or synchronous), rated hp, speed, voltage and current, efficiency and power factor at

2, 3/4 and full load, stator reactance and reactance, rotor reactance and reactance, magnetizing reactance.

2.8 Circuit breakers and switches: rated voltage, interrupting time and continuous, interrupting and momentary currents. Provide normal, long-time emergency and short-time emergency thermal ratings.

2.9 Protective relays and systems: ANSI function number, quantity manufacturer's catalog number, range, descriptive bulletin, tripping diagram and three-line diagram showing AC connections to all relaying and metering.

2.10 CTs and VTs: location, quantity, rated voltage, current and ratio.

2.11 Surge protective devices: location, quantity, rated voltage and energy capability.

### 3.0 Other

3.1 Additional data to perform the Distribution Facilities Impact Study will be provided by the Interconnecting Customer as requested by the Company.

3.2 The Company reserves the right to require specific equipment settings or characteristics necessary to meet NEPOOL and NPCC criteria and standards.

## **EXHIBIT 5**

### **Form of Distribution Facilities Detailed Study Agreement**

This agreement dated \_\_\_\_\_, is entered into by  
(the Interconnecting Customer) and the Company for the purpose of setting forth the terms,  
conditions and costs for conducting a Distribution Facilities Detailed Study relative to  
\_\_\_\_\_. The Distribution Facilities Detailed Study will  
determine the detailed engineering, design and cost of the facilities necessary to satisfy the  
Interconnecting Customer's request for service interconnecting with the Company's Distribution  
System.

1. The Interconnecting Customer agrees to provide, in a timely and complete manner, all required information and technical data necessary for the Company to conduct the Distribution Facilities Detailed Study. Where such information and technical data was provided for the Distribution Facilities Impact Study, it should be reviewed and updated with current information, as required.
2. All work pertaining to the Distribution Facilities Detailed Study that is the subject of this Agreement will be approved and coordinated only through designated and authorized representatives of the Company and the Interconnecting Customer. Each party shall inform the other in writing of its designated and authorized representative.
3. The Company will advise the Interconnecting Customer of additional studies, as in its sole discretion deem necessary, in accordance with Good Utility Practice. The Company will not proceed with additional studies without the Interconnecting Customer's consent.
4. The Company contemplates that it will require [specify time] to complete the Distribution Facilities Detailed Study. Upon completion of the Distribution Facilities Detailed Study, the Company will provide a Distribution Facilities Detailed Study Report to the Interconnecting Customer based on the information provided and developed as a result of this effort. If, upon review of the Distribution Facilities Detailed Study Report, the

Interconnecting Customer decides to pursue its interconnection service request, the Interconnecting Customer must sign an Interconnection Service Agreement with the Company. The Distribution Facilities Impact Study and Distribution Facilities Detailed Study, together with any additional studies contemplated in Paragraph 3, shall form the basis for the Interconnecting Customer's proposed use of the Company's Distribution System and shall be furthermore utilized in obtaining necessary third-party approvals of any facilities and requested services. The Interconnecting Customer understands and acknowledges that any use of the study results by the Interconnecting Customer or its agents, whether in preliminary or final form should such approval be required, prior to NEPOOL 18.4 approval, is completely at the Interconnecting Customer's risk and that the Company will not guarantee or warrant the completeness, validity or utility of the study results prior to NEPOOL 18.4 approval.

5. The estimated costs contained within this Agreement are the Company's good faith estimate of its costs to perform the Distribution Facilities Detailed Study contemplated by this Agreement. The Company's estimates do not include any estimates for wheeling charges that may be associated with the transmission of Facility output to third parties or with rates for station service. The actual costs charged to the Interconnecting Customer by the Company may change as set forth in this Agreement. Prepayment will be required for all study, analysis, and review work performed by the Company or its Designated Agent's personnel, all of which will be billed by the Company to the Interconnecting Customer in accordance with Paragraph 6 of this Agreement.
6. The payment required is \$\_\_\_\_\_ from the Interconnecting Customer to the Company for the primary system analysis, coordination, and monitoring of the Distribution Facilities Detailed Study to be performed by the Company for the Interconnecting Customer's requested service. Such amount shall be payable in full to the Company prior to the Company beginning the work. The Company will, in writing, advise the Interconnecting Customer in advance of any cost increases for work to be performed if the total amount increases by 10% or more. Any such changes to the Company's costs for the study work to be performed shall be subject to the Interconnecting Customer's consent. The

Interconnecting Customer shall, within thirty (30) days of the Company's notice of increase, either authorize such increases and make payment in the amount set forth in such notice, or the Company will suspend the Distribution Facilities Detailed Study and this Agreement will terminate.

In the event this Agreement is terminated for any reason, the Company shall refund to the Interconnecting Customer the portion of the above credit or any subsequent payment to the Company by the Interconnecting Customer that the Company did not expend or commit in performing its obligations under this Agreement. Any additional billings under this Agreement shall be subject to an interest charge computed in accordance with the provisions of the Interconnection Requirements Document. Payments for work performed shall not be subject to refunding except in accordance with Paragraph 7 below.

7. If the actual costs for the work exceed prepaid estimated costs, the Interconnecting Customer shall make payment to the Company for such actual costs within thirty (30) days of the date of the Company's invoice for such costs. If the actual costs for the work are less than that prepaid, the Company will credit such difference toward the Company costs unbilled, or in the event there will be no additional billed expenses, the amount of the overpayment will be returned to the Interconnecting Customer with interest computed in accordance with the provisions of the Interconnection Requirements Document.
8. Nothing in this Agreement shall be interpreted to give the Interconnecting Customer immediate rights to wheel over or interconnect with the Company's Distribution System.
9. Within one (1) year following the Company's issuance of a final bill under this Agreement, the Interconnecting Customer shall have the right to audit the Company's accounts and records at the offices where such accounts and records are maintained, during normal business hours; provided that appropriate notice shall have been given prior to any audit and provided that the audit shall be limited to those portions of such accounts and records that relate to service under this Agreement. The Company reserves the right to assess a reasonable fee to compensate for the use of its personnel time in

assisting any inspection or audit of its books, records or accounts by the Interconnecting Customer or its Designated Agent.

10. The Interconnecting Customer agrees to indemnify and hold the Company and its affiliated companies and directors, officers, employees, and agents of each of them (collectively "Affiliates") harmless from and against any and all damages, costs (including attorney's fees), fines, penalties and liabilities, in tort, contract, or otherwise (collectively "Liabilities") resulting from claims of third parties arising, or claimed to have arisen as a result of any acts or omissions of the Company or its Affiliates under this Agreement. The Interconnecting Customer hereby waives recourse against the Company and its Affiliates for, and releases the Company and its Affiliates from, any and all Liabilities for or arising from damage to its property due to a performance under this Agreement by the Company or its Affiliates.
11. If either party materially breaches any of its covenants hereunder, the other party may terminate this Agreement by serving notice of same on the other party to this Agreement.
12. This agreement shall be construed and governed in accordance with the laws of the Commonwealth of Massachusetts and with 220 C.M.R. §8.00 et seq.
13. All amendments to this Agreement shall be in written form executed by both parties.
14. The terms and conditions of this Agreement shall be binding on the successors and assigns of either party.
15. This Agreement will remain in effect for a period of up to two years from its effective date and is subject to extension by mutual agreement. Either party may terminate this Agreement by thirty (30) days' notice except as is otherwise provided herein.

Interconnecting Customer:

The Company:

Massachusetts Electric Company  
Nantucket Electric Company

M. D. T. E. No. 1052  
Interconnection Requirements Document  
Exhibit 5  
Sheet 62

Name: \_\_\_\_\_

Name:

Title: \_\_\_\_\_

Title:

Date: \_\_\_\_\_

Date:

**EXHIBIT 6**  
**Insurance Requirements**

These Insurance Requirements apply to all Category 2 Facilities, except Category 2 Facilities that are Net Metered, and all Category 3, 4, and 5 Facilities. The Interconnecting Customer, at its own cost and expense, shall procure and maintain insurance in the forms and amounts acceptable to the Company at the following minimum levels of coverage:

- a) For Category 2 Facilities installed at a residential location:
  - Comprehensive General Liability Coverage including Operations, Contractual Liability and Broad Form Property Damage Liability written with limits no less than \$1,000,000.00 combined single limit for Bodily Injury Liability and Property Damage Liability.
- b) For Category 2 Facilities installed at a non-residential location and for all Category 3, 4 and 5 Facilities:
  - Statutory coverage for workers' compensation, and Employer's Liability Coverage with a limit no less than \$500,000.00 per accident;
  - Comprehensive General Liability Coverage including Operations, Contractual Liability and Broad Form Property Damage Liability written with limits no less than \$5,000,000.00 combined single limit for Bodily Injury Liability and Property Damage Liability; and
  - Automobile Liability for Bodily Injury and Property Damage to cover all vehicles used in connection with the work with limits no less than \$1,000,000.00 combined single limit for Bodily Injury and Property Damage Injury.

Prior to commencing the work on a Category 2 Facility at a residential location, the Interconnecting Customer shall have its insurer furnish to the Company certificates of insurance evidencing the insurance coverage required above.

Prior to commencing the work on a Category 2 Facility at a non-residential location or on a category 3, 4 or 5 Facility, the Interconnecting Customer shall have its insurer furnish to the Company certificates of insurance evidencing the insurance coverage required above and the Interconnecting Customer shall notify and send copies to the Company of any policies maintained hereunder written on a "claims-made" basis. The Company may at its discretion require the Interconnecting Customer to maintain tail coverage for five years on all policies written on a "claims-made" basis.

Every contract of insurance providing the coverages required in this provision shall contain the following or equivalent clause: "No reduction, cancellation or expiration of the policy shall be effective until thirty (30) days from the date written notice thereof is actually received by the Interconnecting Customer.≡ Upon receipt of any notice of reduction, cancellation or expiration, the Interconnecting Customer shall immediately notify the Company.

The Company and its Affiliates shall be named as additional insureds, as their interests may appear, on the Comprehensive General Liability and Automobile Liability policies described above.

The Interconnecting Customer shall waive all rights of recovery against the Company for any loss or damage covered by said policies. Evidence of this requirement shall be noted on all certificates of insurance provided to the Company.

Massachusetts Electric Company  
Nantucket Electric Company  
D.T.E. Docket No. 02-38

## Exhibit 2

### Interconnection Process for Small (10 kW or less) Customer-Owned Generating Facilities

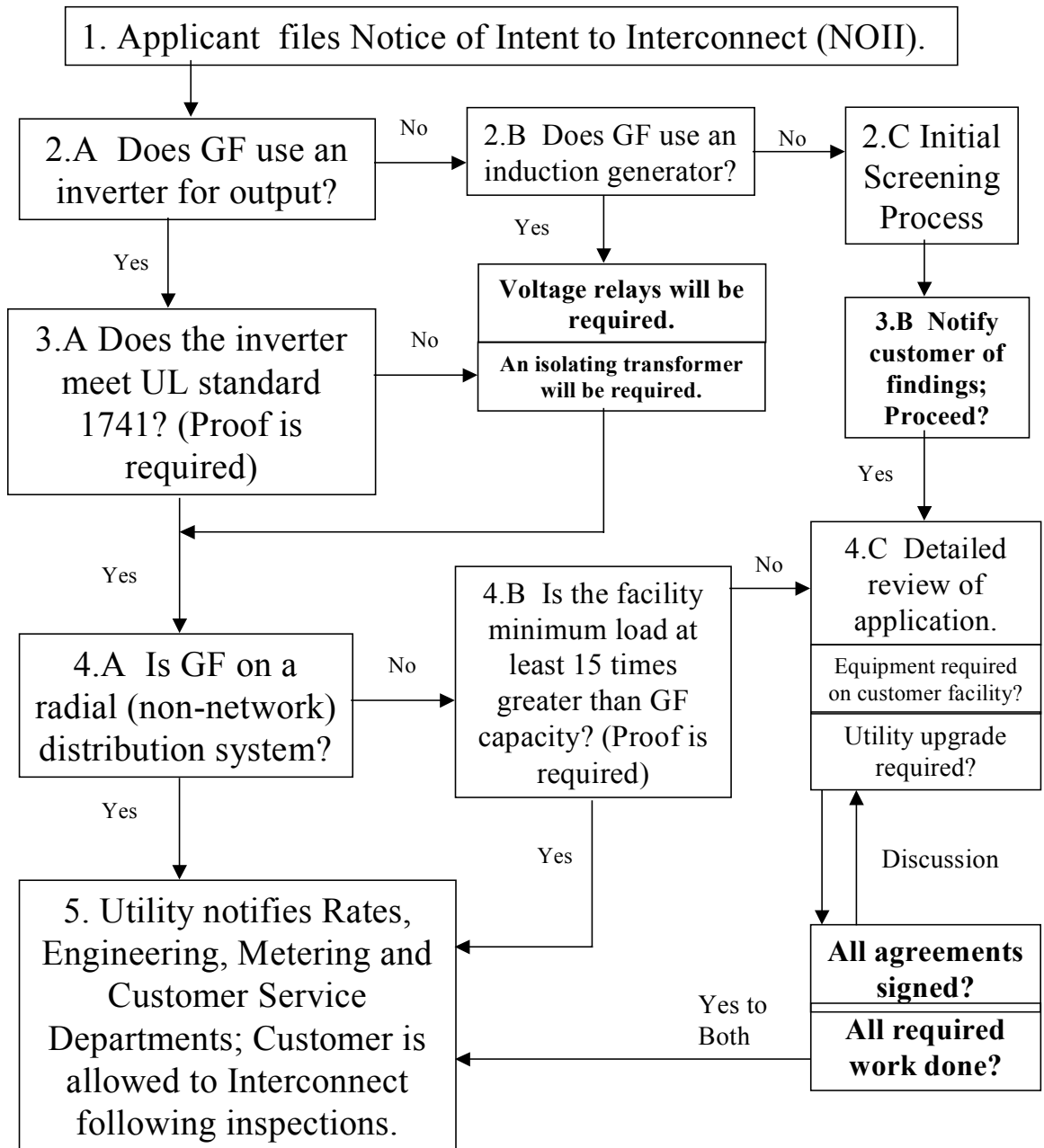
### **Interconnection Process for Small (10kW or less) Customer-Owned Generating Facilities.**

Certain types of DG in this size category, namely systems using an inverter to provide electrical output, benefit significantly from two national standards developed by the international Institute of Electrical and Electronic Engineers, Inc. (IEEE) and Underwriters Laboratories, Inc. (UL). IEEE Standard 929-2000 applies to photovoltaic (PV) systems of 10 kW or less; UL Standard 1741 specifies testing procedures and minimum requirements for inverters employed in this size category of PV systems. The Company will accept customer-owned PV systems satisfying these two standards, and even other energy sources employing UL 1741-compliant inverters (which may include wind turbines and small hydro systems) as meeting the minimum required protection *for the generating facility (GF) alone*. If the customer is served by a network (versus a radial) distribution system, additional interconnection requirements must be met for the proper operation of specialized network protective devices and to maintain reliable service to other customers served on the network.

Figure 1 on the following page illustrates the straightforward process for interconnection of customer-owned generating facilities rated at 10 kW or less. In particular, if the customer has an inverter-based system meeting UL Standard 1741 and is served by a typical radial feeder, the interconnection agreement can be approved as soon as the required documentation is acknowledged by the Company. Field inspection of the system to evaluate conformance with the application is the final step before physical interconnection is permitted.

**Figure 1**

# MECo Process for Interconnection of Customer-owned Generators Rated at 10 kW or Less

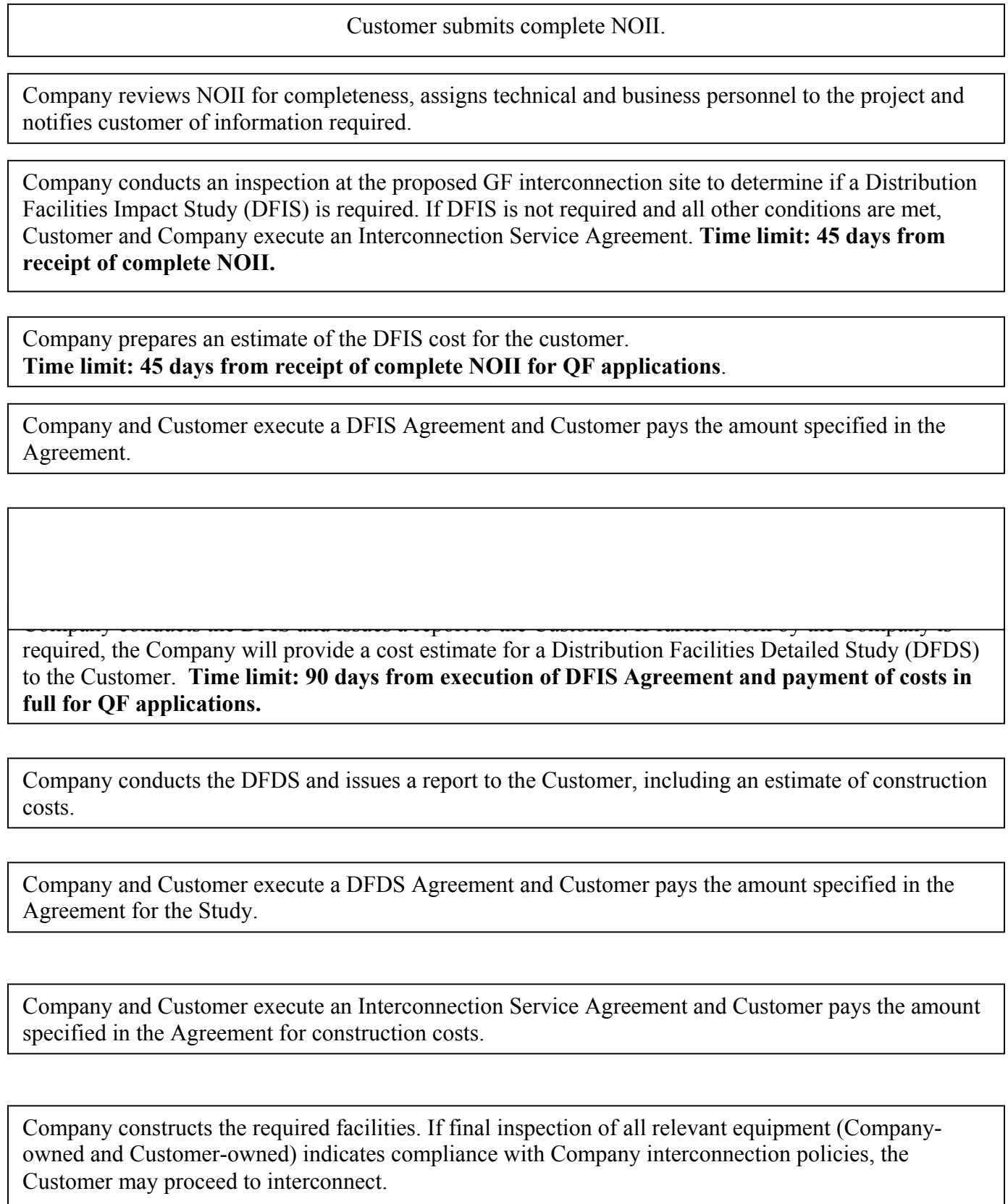


GF-PROC-JB-J19C.PPT

### Exhibit 3

#### Overview of Interconnection Process for Larger GFs (10 kW to 10 MW)

**Figure 2: Overview of Interconnection Process for Larger GFs (10 kW to 10 MW)**



Massachusetts Electric Company  
Nantucket Electric Company  
D.T.E. Docket No. 02-38

Exhibit 4

Mass. Electric's Load Curtailment Pilot Program Filing

Exhibit 4 is being provided in a separate bound document.